Study on Dietary Exposure of Sweeteners in Thai Consumers

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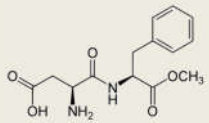
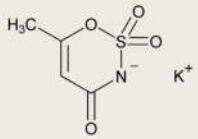
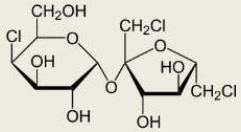
Thailand Risk Assessment and Surveillance Center (TRAC)

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Research team

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Outline of presentation

1. Introduction
2. Objectives
3. Method of study
4. Results of the study
5. Conclusion and recommendation

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1. Introduction

- ❖ **Sweeteners, particularly those low or no caloric value, have been approved by various organizations including CODEX. Some of them were used widely as food additives in many countries around the world.**
- ❖ **The additives became more popular as the health awareness amongst consumers grew**

❖ The obesity is increasing as a global trend, leading to the increase in NCDs. The consumption of energy dense food (high consumption of sugar from food and drink) is one of the important factors due to consumer preference for sweet taste.

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❖ Alternative sources of sweetness are being sought for use in place of sugar in various foods.

❖ Low/non caloric sweeteners (LNCS) became more popular and are used widely, particularly drinks and other food items as the low calorie options. The use of LNCS has been growing rapidly in recent years

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❖ The process of approval for use of LNCS as food additive has been conducted by the regulatory agencies, through the use of risk analysis concept set by CODEX.

❖ The risk assessment is applied in setting the maximum use level of sweeteners in combination with the food consumption data of the population in the country.

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❖ In Thailand, the Thai FDA has been using the national food consumption data surveyed in 2006 (ACFS). The data set does not cover some of the food items developed in the recent years.

❖ Therefore, the dietary exposure of three important sweeteners (aspartame, acesulfame-k and sucralose) has been studied in Thai consumers.

2. OBJECTIVES

General:

To determine the usage and potential/actual exposure of consumers to Low/No Calorie sweeteners (LNCS: focus on Aspartame, Ace-K and sucralose)

Specific:

1. **Market survey of product containing LNCS (follow CODEX category for screen, industrial information and ACFS list of foods)**
2. **To determine the household use of LNCS sweetener in foods/beverages containing sweeteners and others sources as mentioned above which consumed at home.**

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3. **To determine the consumption of LNCS sweetener in foods/beverages containing sweeteners and others sources as mentioned above which consumed outside the home by individual consumers.**
4. **To determine the levels of LNCS sweetener in foods/beverages containing sweeteners or dishes and processed foods available to consumers**
5. **To evaluate the total exposure of LNCS sweetener from the data obtained from survey studies.**

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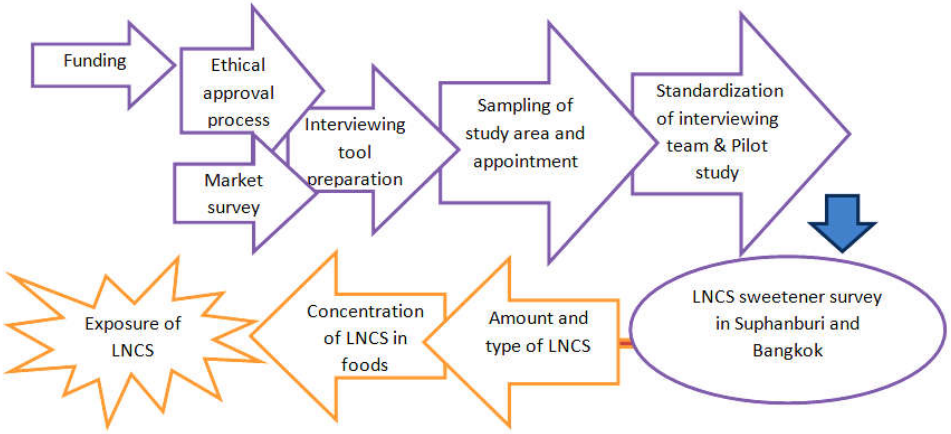
3. METHODS OF STUDY

1) Study process



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2) Ethics Certification in Human by MU-SSIRB

Certificate of MU-SSIRB Approval

Certificate of Approval No.:	2015/250.2807
MU-SSIRB No.:	2015/280 (B2)
Title of Project:	A STUDY ON DIETARY EXPOSURE OF SWEETENERS IN THAI CONSUMERS
Principal Investigator:	Associate Professor Dr. Sonjsak Srianujata
Name of Institution:	Institute of Nutrition, Mahidol University
Approval Includes:	1) MU-SSIRB Submission form version received date 24 July 2015 2) Participant Information sheet version date 24 July 2015 3) Informed Consent Form version date 24 July 2015 4) Questionnaire version received date 24 July 2015

The Committee for Research Ethics (Social Sciences) is in full compliance with International Guidelines of Human Research Protection such as Declaration of Helsinki, The Belmont Report, CIOMS Guidelines and the International Conference on Harmonization in Good Clinical Practice (ICH-GCP)

Date of Approval:	July 28, 2015
Date of Expiration:	July 27, 2016

Objective 1:

Market survey of product containing LNCS (follow CODEX category for screen, industrial information and ACFS list of foods)

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3) Market survey

Market survey places

✓**Nakhon Pathom province**
- **Lotus (Salaya)**
  - **7-11 (Sa haporn branch at Salaya)**
- **Food land (The Biro Salaya)**
- **Max value (Salaya Mall)**
- **TOP Supermarket (Central Salaya)**

✓**Samut Sakhon province and Phetchaburi**
- **CJ (Bann Bor branch)**
- **Mae-kim-lite (แม่กิมไล้) (Phetchaburi)**

✓**Bangkok**
- **Gourmet Market (Siam Paragon)**
- **Home Fresh Mart (The Mall Bangkhae) and**
- **Villa Market (Soi Aree)**

The activity in market survey
- Record brands of LNCS products
- Buy some products for taking a photograph

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Results of "Market survey"

LNCS sweetener items could be separated in to 2 items,
1. Add in food type and
2. Mixed in food type.

LNC sweetener products in Thailand markets

Food groups	Number of Products	Number of Brands
1. Add in food	15	11
2. Mixed in food		
2.1 General food	13	5
2.2 Specific food	39	14
2.3 Snack	0	0
2.4 Beverage		
2.4.1 Coffee/Tea/Co-co/Chocolate/Ginger/Herb	85	32
2.4.2 Cereal	2	2
2.4.3 Soft drinks	70	23
2.4.4 Energy drinks	5	4
2.5 Candy	59	16
2.6 Chewing gum	41	6
2.7 Seasoning	2	1
Total	**331**	**114**

Note: Data of June to July 2015

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The examples of LNCS product groups in Thailand

Add in foods

Mixed in foods

Objective 2:

To determine the household use of LNCS in foods/beverages containing sweeteners which are consumed at home and outside.

- Tool development
- Selection of study areas and study design
- Standardization and training of interviewers
- Pretest and pilot study
- Consumption survey of products containing LNCS

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Tool development

1) Photo book preparation
2) Questionnaire
   - General question
   - Quantitative Food Frequency Questionnaire; FFQ
   - 24-hr dietary recall


Appendix 2.1- General question


Appendix 2.2-Food Frequency Questionnaire (FFQ)


Appendix 2.3-24-hr dietary recall


Appendix 2.4-Photo book

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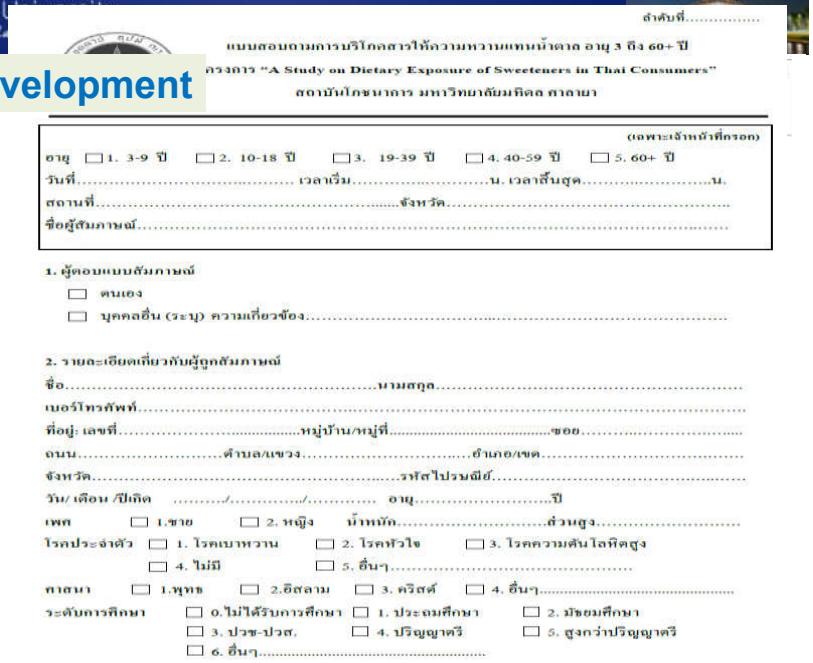
Tool development



แบบสอบถามการบริโภคสารให้ความหวานแทนน้ำตาล อายุ 3 ถึง 60+ ปี

การวิจัย "A Study on Dietary Exposure of Sweeteners in Thai Consumers"

สถาบันโภชนาการ มหาวิทยาลัยมหิดล ศาลายา

ลำดับที่.....

(เฉพาะเจ้าหน้าที่กรอก)

อายุ ☐1. 3-9 ปี ☐2. 10-18 ปี ☐3. 19-39 ปี ☐4. 40-59 ปี ☐5. 60+ ปี

วันที่..... เวลาเริ่ม.....น. เวลาสิ้นสุด.....น.

สถานที่.....จังหวัด.....

ชื่อผู้สัมภาษณ์.....

1. ผู้ตอบแบบสัมภาษณ์
   ☐ ตนเอง
   ☐ บุคคลอื่น (ระบุ) ความเกี่ยวข้อง.....

2. รายละเอียดเกี่ยวกับผู้ถูกสัมภาษณ์

ชื่อ.....นามสกุล.....

เบอร์โทรศัพท์.....

ที่อยู่: เลขที่.....หมู่บ้าน/หมู่ที่.....ซอย.....

ถนน.....ตำบล/แขวง.....อำเภอ/เขต.....

จังหวัด.....รหัสไปรษณีย์.....

วัน/ เดือน /ปีเกิด ...../...../..... อายุ.....ปี

เพศ ☐ 1.ชาย ☐ 2. หญิง น้ำหนัก.....ส่วนสูง.....

โรคประจำตัว ☐ 1. โรคเบาหวาน ☐ 2. โรคหัวใจ ☐ 3. โรคความดันโลหิตสูง
☐ 4. ไม่มี ☐ 5. อื่นๆ.....

ศาสนา ☐ 1.พุทธ ☐ 2.อิสลาม ☐ 3. คริสต์ ☐ 4. อื่นๆ.....

ระดับการศึกษา ☐ 0.ไม่ได้รับการศึกษา ☐ 1. ประถมศึกษา ☐ 2. มัธยมศึกษา
☐ 3. ปวช-ปวส. ☐ 4. ปริญญาตรี ☐ 5. สูงกว่าปริญญาตรี
☐ 6. อื่นๆ.....

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Tool development

ลำดับที่.....

แบบสอบถามการบริโภคสารให้ความหวานแทนน้ำตาล (FFQ) ในช่วง 1 เดือนที่ผ่านมา อายุ 3 ถึง 60+ ปี

ชื่อ-นามสกุล.....อายุ.....ปี เพศ ☐ ชาย ☐ หญิง

กลุ่มที่ 1 เติมลงในอาหาร

ที่	ผลิตภัณฑ์	1 หน่วยบริโภค	A (กรัม)	ปริมาณการกินแต่ละครั้ง			ความถี่ในการกิน (ครั้ง/เดือน สัปดาห์หรือวัน)					หมายเหตุ
				<A	A	>A	นานๆที	บ่อย (ครั้ง/สัปดาห์)			บ่อยมาก/ทุกวัน (ครั้ง/วัน)	
							1-3 ครั้ง/ด	1-2	3-4	5-6		
1	D-et วัตถุให้ความหวานแทนน้ำตาล											
	วัตถุให้ความหวานแทนน้ำตาล ชนิดผง	1 ซอง	0.9									
2	ทรูสเลน ซูคราโลส (TRUSLEN SUCRALOSE)											
	วัตถุให้ความหวานแทนน้ำตาล ชนิดผง	1 ซอง	1									
3	ทรอปิคานา สลิม											
	โลว์แคลอรี สวีทเทนเนอร์ คลาสสิค	1 ซอง	2.5									
	ซีโร่	1 ซอง	1.5									
4	อิควล (Equal)											
	วัตถุให้ความหวานแทนน้ำตาล ชนิดผง	1 ซอง	1									

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➢ Tool development

TRAC

แบบฟอร์มการบันทึกอาหารใน 1 วัน

ID............................

ผู้ให้ข้อมูล ☐ ผู้ดูแล ☐ ผู้ดูแลและตนเอง ☐ ตนเอง วันที่สัมภาษณ์ ....

ชื่อผู้ถูกสัมภาษณ์ .... นามสกุล .... เพศ ☐ ชาย ☐ หญิง อายุ.........ปี

อาหารที่กินเมื่อวาน ☐ วันธรรมดา ☐ วันหยุด / หยุดนักขัตฤกษ์ รูปแบบที่กินอาหารเป็นแบบ ☐ ปกติ ☐ พิเศษ ☐ ป่วย

ปริมาณอาหารที่กินเมื่อวานเทียบกับวันอื่นๆ ☐ น้อยกว่า ☐ เท่าๆ กัน ☐ มากกว่า เวลาเริ่มสัมภาษณ์.......................... เวลาสิ้นสุดการสัมภาษณ์..........................

เวลาที่กิน	มื้ออาหาร	แหล่งที่มา	รายการอาหาร	ปริมาณที่กินทั้งหมด	ส่วนประกอบอาหาร	ปริมาณอาหารที่กิน	Code	หมายเหตุ

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➢ Tool development

TRAC THAILAND

สมุดภาพ (Photo book) ประกอบการสัมภาษณ์
แบบสอบถามความถี่ในการบริโภคสารให้ความหวานแทนน้ำตาล
โครงการวิจัย "A Study on Dietary Exposure of Sweeteners in Thai Consumers"
สถาบันโภชนาการ มหาวิทยาลัยมหิดล ศาลายา

331 items of foods and beverages

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กลุ่มที่ 1 ชนิดเติมลงในอาหาร A/1-7

หนึ่งหน่วยบริโภค = 1 ซอง, 1 เม็ด

TRAC THAILAND

Example

1


2


3


4


5


6


7


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กลุ่มที่ 2 ชนิดผสมฯ - 2.1B1/7-13

หนึ่งหน่วยบริโภค = 1 ซอง

TRAC THAILAND

Example

28


29


30


31

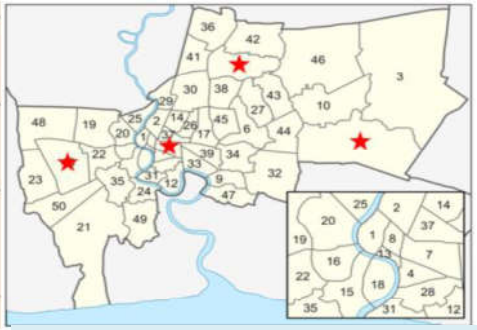

32


33


➢ Selection of study areas

The study was conducted in comparison between urban area (Bangkok) and rural area (Suphanburi).

- Area cluster random sampling was used to select study areas



✓ Muang Suphanburi District
- 4 sub districts

✓ Doembang-nangbuat District
- 4 sub districts

1) Khet Pathum Wan
2) Khet Bang Khen
3) Khet Bang Khae
4) Khet Lat Krabang

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➢ Study population

The household and **population size to be studied were calculated statistically** from the available literature data and from the statistic of **population size in each area.**

- **The estimation of sample size using below equation**

$$N = Z2\ P(1\text{-}P)\ (DEFF)/d^2$$

$$N = \frac{1.962 \times 0.5(0.5)(2)}{0.05^2}$$

1.96 = Z value (∞ = 0.05) or 95% confidence level
P = estimated prevalence of LNCS sweetener consumption = 0.5
1-P = estimated prevalence of not consume LNCS sweetener = 0.5
DEFF = Estimated design effect = in this study estimate as 2
d = tolerable error = 5 %

Required number of participants = 768.32 cases ~ 770 cases

Estimated sample size
Sample size = 770 cases + 10% non response
Sample size =770 + 77 = **847 cases** that could be divided into age groups

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The study age groups

The study population were separated into 5 age groups

1.Children at primary school (3-9 y)

2.High school (10-18 y)

3.University and Young adults (19-39 y)

4.Adults (40-59 y)

5.Elderly (≥60 y)

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➢ Training of interviewers

In order to **standardize the four questionnaires**; general questionnaire, food frequency questionnaire, and the 24-hour recall, the interviewers were trained to follow the protocol to complete the all questionnaires.

The interviewers were trained by Lect. Wanphen Wimonpeerapattana.

➢ Pretest

❖ After the design of the questionnaires are completed, they **were pretested in our target group**.

❖ While the participants were completing the questionnaire, we asked them to think out loud.

❖ Each times they read and answered a question they should tell us exactly what came into their mind.

❖ We took notes on their feedback and modified the questionnaire accordingly to improve it according to the results.

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➢ Pilot study

Before the final questionnaire form was constructed, we also conducted a pilot study to determine if the items were yielding the types of information that was needed. **At Nakhon Pathom province, Thailand, thirty people with all range of age group of interest were interviewed**.

Pilot studies at Institute of Nutrition, Mahidol University

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Examples

Consumption Survey Activity in Suphanburi province, Thailand

- **Banpho Municipal district**

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Examples

Consumption Survey Activity in Bangkok Metropolitan, Thailand

- **Khet Bangkhen District**

Results: Consumption Survey of Suphanburi province, Thailand

The total number of study population in Suphanburi province were **814 cases**.

- Muang Suphanburi District 420 cases,
- Doembangnangbuat District 394 cases

Number of study population in Muang Suphanburi District

Age groups (years)	Urban		Rural		Total of Age groups	
	male	female	male	female	male	female
3-9	12	19	20	24	32	43
10-18	17	21	25	37	42	58
19-39	44	18	3	18	47	36
40-59	13	34	17	31	30	65
≥60	12	22	18	15	30	37
Total of Areas	98	114	83	125	181	239
	212		208		420	

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Results: Consumption Survey of Suphanburi province, Thailand

Number of study population in Doembangnangbuat District

Age groups (years)	Urban		Rural		Total of Age groups	
	male	female	male	female	male	female
3-9	28	23	23	8	51	31
10-18	28	26	35	37	63	63
19-39	12	21	5	16	17	37
40-59	9	23	15	47	24	70
≥60	9	14	6	9	15	23
Total of Areas	86	107	84	117	170	224
	193		201		394	

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Results: Consumption Survey of Bangkok province, Thailand

Total number of study population in Bangkok province were **806 cases**.

Number of study population by age group in Bangkok

Age groups (years)	Areas (district)								Total of Age groups	
	Pathumwan		Bangkhen		Bangkhae		Ladkrabang			
	male	female	male	female	male	female	male	female	male	female
3-9	15	28	15	24	38	45	19	26	87	123
10-18	23	25	18	32	15	20	23	19	79	96
19-39	35	8	13	38	22	8	33	18	103	72
40-59	10	31	6	32	10	31	2	26	28	120
≥60	1	1	7	13	11	27	3	35	22	76
Total	84	93	59	139	96	131	80	124	319	487
	177		198		227		204		806	

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- **The estimation of sample size using below equation**

$$N = Z2\ P(1-P)\ (DEFF)/d^2$$

$$N = \frac{1.962 \times 0.5(0.5)(2)}{0.05^2}$$

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DEFF = Estimated design effect = in this study estimate as 2
d = tolerable error = 5 %

Required number of participants = 768.32 cases ~ 770 cases per area

Estimated sample size per area
Sample size = 770 cases + 10% non response
Sample size =770 + 77 = **847 cases** that could be divided in to age group

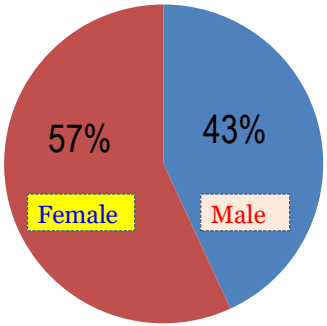
- From the estimation of sample size per area, so total cases of study population: 847 X 2 = 1694

No plus with Non response = 1540

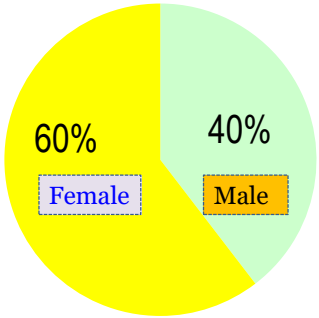
- **Total population in this study: 1620 cases**

Results: Distribution of population between male and female

Suphanburi province



Bangkok



- Total population in this study: 1620 cases

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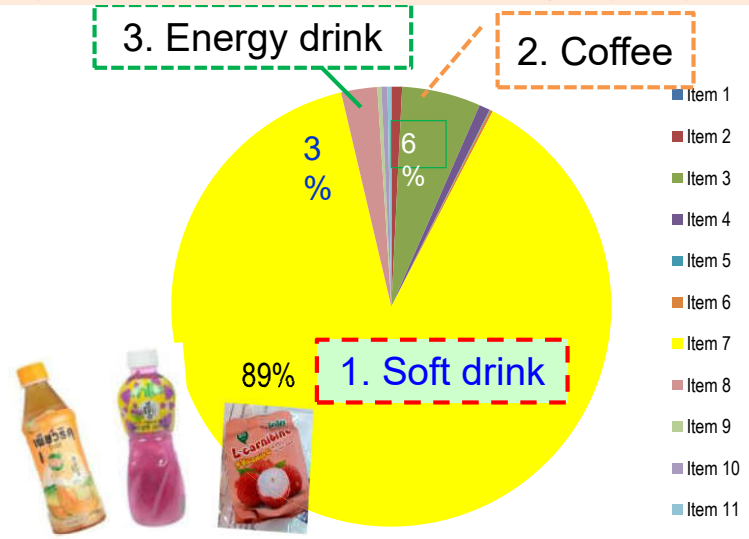
Result: Consumption data

Type of frequently consumed foods/beverages by study population



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Results: Other essential information

Average body weight (kg), which were used for calculation of exposure.

Age group	male	female
3-9	26.4	26.1
10-18	52.1	46.9
19-39	69.2	58.8
40-59	69.7	61.3
≥60	61.2	57.1

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Objective 3:

To determine the levels of LNCS sweeteners in foods/beverages or dishes and processed foods available to consumers

To fulfill the objective 3, the following activities were done.

- Samples containing LNCS were collected from the market and were sent to laboratory for determination of LNCS by HPLC.
- Some data of actual LNCS concentration were contributed by the company, the member of Thailand Industry Council.

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Criteria in selection of samples for LNCS analysis and re-analysis

Criteria 1 in selection of samples for LNCS analysis and re-analysis by HPLC

1. Selected items that were consumed more than 1% of eater only (>13 cases consumed that item)
2. Re-analysis of the items, which known concentration (data from the company and labelling [% containing])

Criteria 2 used maximum limit (ML) level in foods

1. Items that were consumed less than 1% of eater only and
2. Candy and chewing gum

GENERAL STANDARD FOR FOOD ADDITIVES
CODEX STAN 192-1995
Adopted in 1995. Revision 1997, 1999, 2001, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014. 2016

CODEX standard (ML)
Depend on food / beverage

- Aspartame 300-10000 mg/kg
- Aspartame-Aceusulfame K 200-1000 mg/kg
- Aceusulfame K 200-2000 mg/kg
- Sucarlose 30-2500 mg/kg

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Results: Mean concentration of LNCS in product groups (mg/g)

Food groups (items)	Aspartame	Aceusulme-K	Sucarlose
1. Add in food (sweetener pack, light sugar pack, etc.) (15)	21.800	1.133	6.140
2. Mixed in food (316)			
2.1 General food (yogurt, jelly and sweet fish sauce) (13)	0.005	0.258	0.160
2.2 Specific food (Supplement/ Medical food) (39)	0.564	0.565	1.393
2.3 Beverage (162)	0.291	0.279	0.156
2.3.1 Coffee (Can/ 3 in 1) (62)	0.126	0.189	0.265
2.3.2 Tea (3 in 1) (7)	3.235	1.700	0.086
2.3.3 Co-co/ Chocolate and malt (3 in 1) (6)	0.225	0.325	0.150
2.3.4 Ginger/ Cereal and Other (3 in 1) (12)	0.100	0.236	0.200
2.3.5 Soft drinks (Ready to drink) (70)	0.144	0.183	0.068
2.3.6 Energy drinks (Ready to drink) (5)	0.800	0.800	0.025
2.4 Candy (59)	0.958	0.341	0.844
2.5 Chewing gum (41)	3.168	1.041	0.544
2.6 Seasoning (2)	0.000	0.125	0.475

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Objective 2 and 3:

To determine the household use of LNCS sweeteners in foods/beverages consumed at home and outside

To determine the consumption of LNCS sweetener in foods/beverages containing sweeteners and others sources as mentioned above which consumed outside the home by individual consumers

Amount of consumption LNCS data were obtained → Mean or percentile data were used for exposure or intake calculation

Objective 4:

To determine the levels of LNCS sweeteners in foods/beverages or dishes and processed foods available to consumers

Concentration data were obtained and were used for exposure or intake calculation

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Objective 5

To evaluate the total exposure of LNCS sweetener from the data obtained from survey studies.

To fulfill the objective 5, dietary exposure assessment activities were done by combining food consumption data with LCNS concentration data

General equation for dietary exposure

Food consumption (g/day) X Concentration of chemical (mg/g) ÷ 

Dietary exposure mg/kg BW/day

This study used

Point estimation or deterministic estimation model for calculation of dietary exposure

- Calculation of an average dietary exposure is the product of the average consumption of the foods of interest and the average residues of the substance of interest in those foods.
  - All estimated intake from all products were added up to obtain total intake.

Point estimation model

Example

Table 6.3. Food consumption and concentration levels used in the TAMDI calculations[a]

Foods and beverages	Consumption (g/day)	Concentration (mg/g)
Beverages (not alcoholic)	324	UUL1
Foods	133	UUL2
Exceptions:		
- Candy, confectionery	27	UUL3
- Condiments, seasonings	20	UUL4
- Alcoholic beverages	20	UUL5
- Soups, savouries	20	UUL6
- Other exceptions (e.g. chewing gum)	2	UUL7

Mean or 97.5th-percentile

[a] TAMDI (mg/day) = (324 × UUL1) + (133 × UUL2) + (27 × UUL3) + (20 × UUL4) + (20 × UUL5) + (20 × UUL6) + (2 × UUL7).

UUL = allowed maximum (upper use) levels in the different categories of foods

or

- used actual concentration from laboratory
- In case of the detected value was specified not detected or lower than LOD, used half LOQ

Ref.: The TAMDI was used by the European Scientific Committee onFood (SCF) to assess potential exposure to single flavourings (EC, 2003).

Aspartame-Per capita

LNCS intake

Age groups	Sex	N	Sum of Mean exposure (mg/kgBW/day)	Sum of Percentile at 95 Exposure (mg/kgBW/day)
3-9 yr.	Male	170	1.95	8.30
	Female	197	1.67	6.65
	Total	367	1.80	-
10-18 yr.	Male	184	1.77	8.40
	Female	217	1.07	5.37
	Total	401	1.39	-
19-39 yr.	Male	168	0.61	2.99
	Female	145	0.43	2.53
	Total	313	0.53	-
40-59 yr.	Male	81	0.31	1.36
	Female	255	0.18	0.70
	Total	336	0.23	-
≥ 60 yr.	Male	67	0.05	0.18
	Female	136	0.12	0.50
	Total	203	0.09	-
Total	Male	670	1.18	-
	Female	950	0.72	-
	Total	1620	0.91	-

Acesulfame K Per capita

LNCS intake

Age groups	Sex	N	Sum of Mean exposure (mg/kgBW/day)	Sum of Percentile at 95 Exposure (mg/kgBW/day)
3-9 yr.	Male	170	2.45	10.26
	Female	197	2.13	8.56
	Total	367	2.28	-
10-18 yr.	Male	184	2.09	10.14
	Female	217	1.32	6.76
	Total	401	1.68	-
19-39 yr.	Male	168	0.68	3.12
	Female	145	0.60	3.19
	Total	313	0.64	-
40-59 yr.	Male	81	0.30	1.69
	Female	255	0.19	0.87
	Total	336	0.22	-
≥ 60 yr.	Male	67	0.06	0.21
	Female	136	0.10	0.46
	Total	203	0.09	-

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Sucralose- Per capita

LNCS intake

Age groups	Sex	N	Sum of Mean exposure (mg/kgBW/day)	Sum of Percentile at 95 Exposure (mg/kgBW/day)
3-9 yr.	Male	170	1.01	4.33
	Female	197	0.91	3.70
	Total	367	0.96	-
10-18 yr.	Male	184	0.79	3.80
	Female	217	0.60	2.89
	Total	401	0.69	-
19-39 yr.	Male	168	0.32	1.53
	Female	145	0.38	1.91
	Total	313	0.35	-
40-59 yr.	Male	81	0.23	1.37
	Female	255	0.14	0.61
	Total	336	0.17	-
≥ 60 yr.	Male	67	0.04	0.17
	Female	136	0.09	0.38
	Total	203	0.07	-

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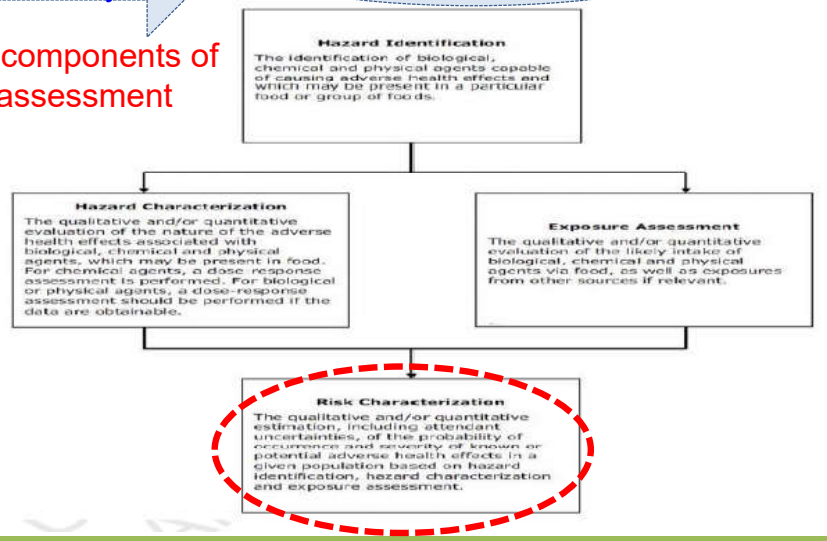
The next step in our study

Risk characterization

The components of risk assessment



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Risk estimation from exposure of Low/No Caloric Sweetener

The resulting estimated dietary exposure is used in the fourth step of risk assessment, the risk characterization step.

$$\text{Hazard Quotient (HQ)} = \frac{\text{Dietary exposure}}{\text{ADI}}$$

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Risk estimation from exposure of LNCS sweetener

Aspartame-Per capita ADI value of codex 40 mg/Kg bw/day

Age groups	Sex	N	Sum of Mean exposure (mg/kgBW/day)	% of ADI (Codex)	Sum of Percentile at 95 Exposure (mg/kgBW/day)	% of ADI (Codex)
3-9 yr.	Male	170	1.95	4.87	8.30	20.76
	Female	197	1.67	4.17	6.65	16.62
	Total	367	1.80	4.50	-	-
10-18 yr.	Male	184	1.77	4.44	8.40	20.99
	Female	217	1.07	2.68	5.37	13.43
	Total	401	1.39	3.49	-	-
19-39 yr.	Male	168	0.61	1.52	2.99	7.47
	Female	145	0.43	1.07	2.53	6.32
	Total	313	0.53	1.32	-	-
40-59 yr.	Male	81	0.31	0.77	1.36	3.40
	Female	255	0.18	0.45	0.70	1.76
	Total	336	0.23	0.57	-	-
≥ 60 yr.	Male	67	0.05	0.14	0.18	0.45
	Female	136	0.12	0.30	0.50	1.24
	Total	203	0.09	0.23	-	-
Total	Total	1620	0.91	2.28		

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Aspartame-Eater only ADI value of codex 40 mg/Kg bw/day

Age groups	Sex	Sum of Mean exposure (mg/kgBW/day)	% of ADI (Codex)	Sum of Percentile at 95 Exposure (mg/kgBW/day)	% of ADI (Codex)
3-9 yr.	Male	3.47	8.68	13.27	33.18
	Female	3.11	7.77	8.18	20.45
	Total	3.32	8.31	-	-
10-18 yr.	Male	4.93	12.32	19.61	49.02
	Female	2.91	7.28	14.92	37.29
	Total	4.06	10.14	-	-
19-39 yr.	Male	2.55	6.38	11.22	28.06
	Female	1.98	4.94	13.88	34.70
	Total	2.37	5.92	-	-
40-59 yr.	Male	2.46	6.15	1.69	4.22
	Female	1.63	4.08	1.54	3.84
	Total	1.93	4.83	-	-
≥ 60 yr.	Male	1.26	3.14	0.00	0.00
	Female	1.18	2.95	1.40	3.50
	Total	1.66	4.14	-	-

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Acesulfame K- Per capita ADI value of codex 15 mg/Kg bw/day.

Age groups	Sex	N	Sum of Mean exposure (mg/kgBW/day)	% of ADI (Codex)	Sum of Percentile at 95 Exposure (mg/kgBW/day)	% of ADI (Codex)
3-9 yr.	Male	170	2.45	16.31	10.26	68.42
	Female	197	2.13	14.18	8.56	57.05
	Total	367	2.28	15.17	-	-
10-18 yr.	Male	184	2.09	13.91	10.14	67.57
	Female	217	1.32	8.83	6.76	45.07
	Total	401	1.68	11.17	-	-
19-39 yr.	Male	168	0.68	4.52	3.12	20.83
	Female	145	0.60	4.02	3.19	21.25
	Total	313	0.64	4.29	-	-
40-59 yr.	Male	81	0.30	1.98	1.69	11.30
	Female	255	0.19	1.29	0.87	5.80
	Total	336	0.22	1.46	-	-
≥ 60 yr.	Male	67	0.06	0.43	0.21	1.42
	Female	136	0.10	0.66	0.46	3.06
	Total	203	0.09	0.59	-	-

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Acesulfame K -Eater only ADI value of codex 15 mg/Kg bw/day.

Age groups	Sex	Sum of Mean exposure (mg/kgBW/day)	% of ADI (Codex)	Sum of Percentile at 95 Exposure (mg/kgBW/day)	% of ADI (Codex)
3-9 yr.	Male	3.86	25.74	15.67	104.50
	Female	3.37	22.48	10.86	72.38
	Total	3.65	24.30	-	-
10-18 yr.	Male	4.44	29.63	21.15	140.99
	Female	2.88	19.23	11.98	79.89
	Total	3.91	26.05	-	-
19-39 yr.	Male	2.27	15.15	11.97	79.80
	Female	2.06	13.73	5.90	39.32
	Total	2.22	14.81	-	-
40-59 yr.	Male	1.65	10.99	2.40	15.98
	Female	1.14	7.60	2.99	19.91
	Total	1.37	9.11	-	-
≥ 60 yr.	Male	1.21	8.08	0.00	0.02
	Female	0.97	6.49	1.82	12.13
	Total	1.46	9.72	-	-

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Sucralose- Per capita ADI value of codex 15 mg/Kg bw/day.

Age groups	Sex	N	Sum of Mean exposure (mg/kgBW/day)	% of ADI (Codex)	Sum of Percentile at 95 Exposure (mg/kgBW/day)	% of ADI (Codex)
3-9 yr.	Male	170	1.01	6.75	4.33	28.85
	Female	197	0.91	6.07	3.70	24.64
	Total	367	0.96	6.39	-	-
10-18 yr.	Male	184	0.79	5.28	3.80	25.36
	Female	217	0.60	3.97	2.89	19.28
	Total	401	0.69	4.57	-	-
19-39 yr.	Male	168	0.32	2.12	1.53	10.17
	Female	145	0.38	2.56	1.91	12.73
	Total	313	0.35	2.32	-	-
40-59 yr.	Male	81	0.23	1.54	1.37	9.13
	Female	255	0.14	0.92	0.61	4.10
	Total	336	0.17	1.11	-	-
≥ 60 yr.	Male	67	0.04	0.26	0.17	1.12
	Female	136	0.09	0.62	0.38	2.57
	Total	203	0.07	0.49	-	-

Sucralose -Eater only ADI value of codex 15 mg/Kg bw/day.

Age groups	Sex	Sum of Mean exposure (mg/kgBW/day)	% of ADI (Codex)	Sum of Percentile at 95 Exposure (mg/kgBW/day)	% of ADI (Codex)
3-9 yr.	Male	1.71	11.37	8.94	59.57
	Female	1.63	10.90	9.80	65.30
	Total	1.66	11.08	-	-
10-18 yr.	Male	1.98	13.18	8.75	58.32
	Female	1.49	9.93	18.64	124.24
	Total	1.72	11.47	-	-
19-39 yr.	Male	1.34	8.93	3.42	22.78
	Female	1.39	9.26	5.95	39.70
	Total	1.33	8.89	-	-
40-59 yr.	Male	1.08	7.18	2.50	16.64
	Female	0.75	5.03	3.16	21.06
	Total	0.87	5.81	-	-
≥ 60 yr.	Male	0.47	3.15	0.00	0.01
	Female	1.06	7.04	0.99	6.60
	Total	0.96	6.40	-	-

Conclusion

4. Conclusion

- **This study is the first study to find the actual consumption of LNCS in Thailand, which focused on aspartame, acesulfame K and sucralose.**
- **LNCS items in Thailand could be separated into 2 categories, add in food type and mixed in food type. Cover 114 brands, 331 items.**
- **The top 3 items that frequently consumed by study population were soft-drink or ready-to-drink, energy drink and coffee (3 in 1, can)**

Conclusion

- **The overall picture shows that the most exposed age group for these three LNCS are 3-9, 10-18, and 19-39 yrs.**
- **However, it can be seen that the mean exposure to three LNCS is quite far below the ADI assigned by JECFA.**
- **Some risk of exposure are found in eater only group**
  - **For Acesulfame K in male with the age group of 3-9 yr and 10-18 yr**
  - **For Sucralose in female with the age group of 10-18 yr.**

5. Recommendation

❖ It is recommended that these sweetener should be use with caution as some groups of population may be at risk of over exposure. These sweeteners should be used according to the guidelines and GMP principles.

❖ The criteria of the use of food additives is to be use at its lowest level that it is required to exert its functions and not at it maximum limit (ML) level.

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ILSI Southeast Asia Region
(Thailand Industry Council)

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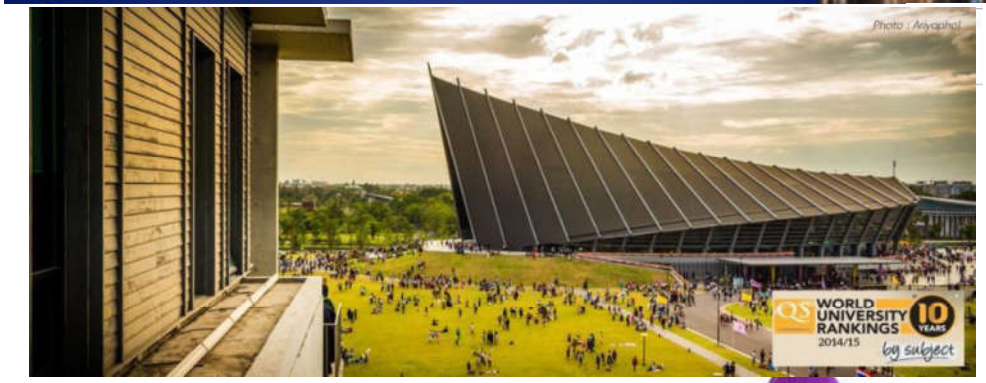

THANK YOU
ขอบคุณครับ