A COMPARATIVE STUDY OF NUTRITIONAL QUALITY AND AMOUNT IN GREEN LETTUCE FROM ORGANIC AND CONVENTIONAL PLANT BASED

NORATHEP IAMKAEW

MASTER OF SCIENCE
IN
ANTI-AGING AND REGENERATIVE SCIENCE

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ABSTRACT

The health benefits of consuming organic compared to conventional cabbage are unclear. This study aimed at evaluating the nutrient and contaminant of organic versus conventional cabbage.

Objectives: To ascertain possible nutritional quality differences of leafy cabbage looking at supplement substance of organic and conventional products use statistical methods to identify significant differences in the data.

Design: Published comparative measurements of organic and conventional nutrients content were gone into a database for count. For every organic to-conventional examination, a percent distinction was computed:

(Organic - Conventional)/Conventional x 100.

For nutrients where there was sufficient information, the t-test was used to identify significant differences in nutrient content as represented by the percent difference.

Results: Conventional harvests contained significantly more dietary fiber, soluble dietary fiber and insoluble dietary fiber, Vitamin C, B-carotene, Calcium, Nitrite and

significant less Phosphorus, Nitrate than Organic yields. There were nonsignificant patterns of Escherichia coli and Salmonella spp.

Conclusions: There have all the earmarks of being certified contrasts in the supplement substance of organic and conventional harvests.

Keywords: Conventional/Organic/Vitamin C/B-carotene/Calcium/Nitrate/Phosphorus, Escherichia Coli/Salmonella spp.

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CHAPTER 1

INTRODUCTION

Thailand is predominantly an agriculture-based country. Agriculture sector has long been called the country's "backbone" since the majority of population derives their livelihood and income from agriculture sector. With a favourable climate and well-developed agricultural processing facilities.Thailand consistently ranks as a major agriculture export not only regionally but also worldwide, importantly in 2014 Thailand was a world rice exporter champion.

The utilization of agribusiness chemicals, for example, manure and pesticides assume a vital part in expanding crop creation and efficiency. Thailand imports 25 billion baht worth of substance manures in addition to sum to 7 billion baht of pesticides yearly. Environmental effects have elevated over the time, including potential reduction of the soil and water assets, furthermore crucial effect to human wellbeing.

Organic farming is the most dynamic and quickly developing division of the worldwide food industry, since the expanding customer awareness of safety and ecological issues. Organic horticulture turned into a noteworthy strategy topic for agrarian advancement in Thailand.

Mindful of the significance of organic agribusiness, Organic cultivating was enrolled as an imperative national plan, to advance the protected sustenance and reinforcing the national fare limit. Numerous administration powers have started tasks and exercises to focus on organic cultivating supportability. However, few solid projects have yet been actualized successfully.

Thai organic agribusiness has seen a major help in the last couple years as the Thai organic part has appreciated consistent development and improvement in its domestics and international markets. The creative endeavors of the Thai private area seem to have paid off. For example, a private national affirmation body has been

created, which is presently turning off to an Asia-wide regional stage. Likewise developed, has been a competency building program for work force required in organic undertakings and a organic item anchor administration framework prompting a territorial preparing platform. A domestic market is also developing and has yet to tap organic exports from neighbouring countries.

Thailand's organic part has presumably passed the early phase of advancement and has begun entering a development stage. The general public and private division alike are quick to get included and advance organic cultivating as they progressively see the advantages of organic cultivating on food security and its ecological commitment. More private part associations from different foundations are quick to put resources into organic generation and exchange, prompting a multiplication of organic ventures with assorted introduction. Other than the customary organic items like rice and fresh cabbages, new organic tasks as of late have moved the center to new item goes like tea, cooking herbs, organic products, sweeteners, aquaculture, materials, beauty care products, and even organic eateries and in addition spas and resorts. Imports of organic items have begun to quit fooling around and general stores have started to put endeavors towards advancing their organic item run keeping in mind the end goal to separate themselves from others. Albeit imported items still have a restricted reach, it means an achievement in the traditionalist mindset of the Thai individuals. At the point when customers continuously begin grabbing the pattern of purchasing imported organics, more rivalry will start to show up, bringing about a complete item range being advertised. This would likewise invigorate the improvement of organic creation and preparing in the nation too. Organic imports are not yet subjected to organic name limitations since the Thai organic directions are still willful.

As indicated by Earth Net Foundation/Green Net, organic cultivating zone as of late is fluctuating at around 20,000 hectares. The change is the aftereffect of insecurity of the administration bolster plan. Political shakiness at the national level is somewhat to fault as the between time government, taking after the military assume control toward the end of 2006, has put little exertion towards proceeding with the organic farming project started by its antecedent. In any case, for the Thai organic division it is a decent lesson to learn: depending on government backing to help

organic cultivating is not economical, particularly when one sees arrangement changes and spending plan underpins stopping to exist, bringing about recently rising organic farms having to rapidly change over back to conventional.

Inside the Thai scholastic setting, organic cultivating is seen as a major aspect of a maintainable cultivating framework, one that locations environmental and social awkwardness. The meaning of Thai organic examination here incorporates all other manageable agribusiness research.

1.1 History

Though organic farming started in Thailand in the 1990s, the research on organic farming in the country began much later. There are basically 3 streams of organic research in Thailand:

1. *NGO oriented*
2. *Public research station oriented*
3. *University-private oriented*

In 2006, Thai organic business sector was esteemed at US$ 31.6 million (948.03 mio Baht), up 152 % from US$ 12.5 m (375.13 m baht) in 2003. Rice is the most vital yield, trailed by cabbages, organic products, corn, then herbs and flavors. EU is one of Thailand's critical organic business sector

In 2008, there were around 16,955 ha (105,967 rai) of confirmed organic. The administration started a 5-year National Organic Development Plan (NODP) and a 5-year Action Plan. Out of the 4 center improvement methodologies, one center was on learning and development. The arrangement was produced by different government offices from 3 primary services: Ministry of Agriculture and Cooperative, Ministry of Commerce, and Ministry of Science and Technology and composed by the National Economic and Social Development.

In Thailand, for the most part the rate of examination venture is extensively low; which is just 0.24% from general GDP, despite the created nation have spent the expense for R&D averagely higher than 2% of GPD. One of third is the interest as far as Engineering and Technology (6,375 million baht), also put resources into

Agriculture (3,571 million baht) and Natural Science (2,919 million baht). The majority of the R&D is an apply research (52%) take after by exploratory advancement (34%) and Basic examination (14%).

No general exploration subjects and needs have been set for organic research in Thailand. The administration through the NODP has a general layout of research needs, yet as the arrangement was produced with little support of different partners, the blueprint just mirrors the impression of people in general division on these issues. NGOs have independently composed their own particular exploration topics and motivation.

A study led by Earth Net Foundation and Thai Organic Trader Association in 2008 discovered roughly 270 wellsprings of writing on Thai organic and practical agribusiness distributed in most recent 15 years, averaging around 20-30 sources for every annum. Almost two-fifths of the exploration concentrated on expansion issues, and the following two most distributed subjects were organic rice creation advances and organic cabbage generation advances with no examination on healthful quality and contaminant.

The format of organic innovative research in Thailand is divided into 3 kinds; which are

(A) The research, which the scientists use the association spending plan/his own particular organization spending plan to direct the exploration. This sort of exploration configuration the specialist needs to recognize the imaginative examination point by them or by association subject.

(B) The research, which the specialist use the monetary allowance from the bolster association. This sort of examination arrangement the analyst needs to distinguish the inventive exploration point by them or by association subject too.

(C) The research – which outsource by organic association to handle. Consequently, the exploration theme is as per the association which might want to do this research.

1.2 Objectives of This Study

In Thailand, there is currently no authoritative statement on the nature and important of differences in content of nutrients and other substances in organically and conventionally produced leafy cabbage. So this study objective will be as follows:

1.2.1 To ascertain possible nutritional quality differences of leafy cabbage sold as “organically grown” and “conventionally grown” in Pakchong Nakornrajsima.

1.2.2 To assess the relative safety of organic cabbage produced base on IFOAM standardization regarding additives and microbial limits.

1.2.3 To support and increase consumer information regarding the reasons for purchasing organic food products. The main reasons are an expectation of a healthier and environmentally friendly means of production and the main barrier to increase the market share of organic food products is consumer information.

1.3 Hypothesises

For this study the following hypothsises were developed base on the results of the previous literature review. Previous reviews have concluded that organically produced foods have a nutrient composition superior to that of conventional foods, although this finding has not been consistent. Many studies in Europe show a non-positive correlation between nutrition of organic food comparative with conventional food, but very few researches in Thailand.

Research hypothesizes will be as follows:

Null Hypothesis: Organic leafy cabbage is not having nutrient content than conventional leafy cabbage by an analytical amount

Alternative Hypothesis: Organic leafy cabbage is having more nutrient content than conventional leafy cabbage by an analytical amount.

Null Hypothesis: Organic leafy cabbage is not having more harmful compounds than conventional leafy cabbage by an analytical amount.

Alternative Hypothesis: Organic leafy cabbage is having more harmful compounds than conventional leafy cabbage by an analytical amount.

1.4 Conceptual Framework

As such, more than 180 studies endeavored to analyze somehow organicly and traditionally delivered food (Gilbert & Shepherd, 1985). Nonetheless, the items analyzed are different (cabbages when all is said in done, particular cabbages, oats, meat, milk, brew, nectar, and so on.) as are the logical rigourousness and the quality and objectivity of the information. These studies can be sorted into three distinct classes (Woese, Lange, Boess & Bögl, 1997). Here is a brief portrayal of every class of study:

1.4.1 Market-arranged supply concentrate on: This sort of study screens the showcased produce accessible to purchasers by gathering nourishment tests from shops offering organic and conventional sustenance. The farthest point to this sort of study is that the maker is obscure, and thus the data about developing conditions (atmosphere, soil sort, administration hones, cultivars, and so forth.) is not accessible. Moreover, the examples contrast in readiness and assortment, which can genuinely influence the quality parameters (Woese et al., 1997).

1.4.2 Studies or perception: These are directed on items from chose homesteads, and subsequently neighboring ranches can be picked with a specific end goal to ensure that the atmosphere is the same and that soil sorts are to some degree comparable. In any case, it is hard to choose genuinely illustrative homesteads and fields for both organic and conventional farming rehearses and the precision of the data given by agriculturists can't be checked (Woese et al., 1997).

1.4.3 Development tests: This is the most exact type of relative study, and it endeavors to figure out if nourishment from various types of creation show particular contrasts in quality and provided that this is true, to which elements and strategies for preparations these distinctions can be ascribed.

Each of these three strategies has its own breaking points, so to accomplish complimentarity and to have a goal and critical examination of organic and traditional items, it is important to look at investigations of every sort (Woese et al., 1997).

At the point when attempting to quantify sustenance quality the decision of what to gauge, how to gauge and what qualities are satisfactory are dictated by the

individual or foundation requiring the estimation. Thought of the planned utilization of the item and of the technique for estimation, accessible innovation, financial aspects and regularly custom assume a part in how nourishment quality is surveyed (Pittler, Abbot, Harkness & Ernst, 1999). One approach to assess nourishment quality is by utilizing physical or compound investigations. The exchange on sustenance quality is frequently restricted to one of legitimate benchmarks for the upper safe points of confinement of microbial defilement or the lower furthest reaches of vitamins, minerals and follow components in an item as it leaves the industrial facility. A consistent theme among distributed organicly versus ordinarily developed produce studies is the colossal variability in the exhibited information. This confounds elucidation of the discoveries and makes it hard to show decisive contrasts.

The quality of cabbages can be categorized into

1. Market: Market quality attributes are primarily visual such as size, shape, color, and defects: punctures, insect wounds, diseased areas, and scarring. In many instances, market quality can include firmness and some chemical determinants: soluble solids (sugars) and acidity levels.

2. Sensory: Sensory quality attributes are those that affect consumption, which include flavor, texture, mouthfeel, and color.

3. Nutritional attributes: Nutritional quality attributes encompass all phytochemicals or phytonutrients that influence human health or wellness, that is, vitamins, minerals, antioxidants, drug-interactive compounds, and secondary metabolites. Nutritional quality attributes and nitrogen fertility will be the focus of this perspective on the comparison of organically versus conventionally grown produce.

In conclusion, we choose observational, analyse study by using representative parameters to be compared. Here are the parameters that were studied and that will be examined in this study:

1. Nutrition Properties; β-carotene, Vitamin C, Calcium, Phosphorus and total dietary fiber (soluble and insoluble dietary fiber)

2. Physical Properties: Taste

3. Additives: Nitrate and Nitrite

4. Microbial: Escherichia coli and Salmonella

Table 1.1 Conceptual Framework

Independent Variable	Controlled Variable	Dependent Variable
Leafy Cabbage from Organic Farm	Irrigation Temperature Humidities and Time of day	β-carotene and Vitamin C Calcium and Phosphorus Soluble and insoluble fiber
Leafy Cabbage from Conventional Farm	Light (both intensity and quality) Soil quality Minerals	Nitrate and Nitrite Taste Escherichia coli Salmonella

1.5 Expected Benefits

The medical advantages and dangers of organic cabbages are issues of noteworthy significance because of the expanding prominence of organic sustenance. The present writing demonstrates that organic produce, in contrast with traditional produce, has a tendency to contain more elevated amounts of vitamin and lower levels of nitrates, however better controlled studies are fundamental keeping in mind the end goal to achieve any authoritative conclusions. It has been completely demonstrated that organic produce contains less and lower levels of pesticides than traditional produce, however the long haul wellbeing results of ingestion of pesticides, and the clinical importance of less and lower levels of pesticides in organic sustenance, has yet to be resolved. Organic cultivating strategies can conceivably prompt microbiological tainting than conventional produce. Considering the issues of supplement substance, pesticides, and microbiological wellbeing, the study might want to get some recommendation that organic produce can conceivably be more gainful than customary produce for the strength of the purchaser or not.

To break down and comprehend on the primary qualities and properties of plants developed after organic and customary techniques, in the endeavor to illuminate give a more profound knowledge into some conceivable contrasts and to think about the two development systems.

1.5.1 To summarise research results regarding nutritional and safety properties of cabbage foods, evidencing qualitative differences observed between the two cultivation methods.

1.5.2 To discover the real difference between organic foods and conventional alternatives when it comes to nutrition and safety. Health-conscious consumers have an interest in knowing if the extra money they spend on organic food is justified.

CHAPTER 2

LITERATURE REVIEW

Thailand, as an agrarian fare nation was asked for to fare produces with higher standard non-poisonous buildup of chemicals by their importing nations.

Amid the previous decade, agro-items trading from Thailand were all the more entirely isolated at the section purpose of importing nations. In reacting to tackle the issues, Thailand's legislature has embraced its backing for organic farming and distributed huge spending plans for various national-level ventures and activities, under a National Organic Agenda. In 2002, the National Bureau of Agricultural Commodity and Food Standards were built up, national organic guidelines characterized and an affirmation framework set up. In 2002 the Department of Agribusiness built up the Organic Crop Institute and endorsed “Organic Thailand” as a national logo. Regardless of the requests for utilization of organic produces are expanding increasingly, the supplies are still not achieving the interest.

Hence the cost of organic items deals in business sector is around 20 - 30% higher than the conventional produces. In past encounters, there were purposeful and non-deliberate fake organic produces found in business sectors all over.

This rate raised the matter of organic item standard, review and accreditation to guarantee the shoppers of genuine and great standard of the organic item. It is, accordingly further enhancements of accreditation and affirmation frameworks are expected to accomplish acknowledgment for both domestic and export of organic produces

2.1 Differences between Organic and Conventional Farming Practices

One of the principle contrasts amongst organic and conventional cultivating is the utilization of manufactured compound composts. Conventional cultivating permits the utilization of manufactured compost and additionally excrement, manure, sewage muck and other soil corrections. Most affirmed organic cultivating just permits the utilization of excrement and fertilizer and other soil added substances, for example, bone or blood dinner. The manufactured N, P and K that is denied in organic cultivating, ordinarily gives supplements that are promptly accessible to the plants, while, in excrement, a portion of the supplements need to experience compound changes before they can be used. Along these lines, both organic and traditional cultivating frameworks can give the crucial macronutrients to the products, just their source and accessibility for uptake are distinctive.

The second real contrast identified with nourishment quality between the two frameworks is the utilization of pesticides and herbicides. Conventional cultivating at the end of the day permits the utilization of any item accessible available (not taboo by law), while organic cultivating permits just a couple of pesticides, and should in this way, depend to a great extent on the utilization of administration practices, for example, culturing and edit turns, to overcome vermin and weed issues. The pesticides allowed in organic cultivating are those that are accepted not to leave any deposit on the items.

The word “organic” refers to the way farmers grow and process agricultural products, such as cabbages. Organic farming practices are designed to encourage soil and water conservation and reduce pollution. Farmers who grow organic produce don't use conventional methods to fertilize, control weeds or prevent disease. For example, rather than using chemical weed killers, organic farmers may conduct more sophisticated crop rotations and spread mulch or manure to keep weeds at bay.

Here are some key differences between conventional farming and organic farming:

Teble 2.1 Differences between Conventional Farming and Organic Farming

Conventional farming	Organic farming
Apply chemical fertilizers to promote plant growth	Apply organic fertilizers, such as manure or compost, to feed soil and plants
Spray synthetic insecticides to reduce pests and disease	Use synthetic herbicides to manage weeds
Give animals antibiotics, growth hormones and medications to prevent disease and spur growth	Give animals organic feed and allow them access to the outdoors. Use preventive measures — such as rotational grazing, a balanced diet and clean housing — to help minimize disease

2.2 Conventional Farming Systems

There are distinctive agrarian frameworks honed in Thailand and the separation is not generally simple and clear. Customary cultivating, common cultivating or feasible practices are frequently viewed as 'organic'. It is likewise hard to discover and name the inverse of organic as there are more different practices than one.

Rural frameworks which haven't been affected by the “green revolution” along these lines still utilize substance composts or pesticides are frequently called conventional cultivating. They can be organic in the event that they agree to all the organic models, yet there are case of traditional frameworks which are not organic also (UN Conference On Trade and Development (2003). A term which is frequently utilized is “Natural Farming”. It can be alluded to the rationality of Masanobu Fukuoka, a Japanese agriculturist who advanced a “donothing farming” which implies the abandonment of composts, pesticides, culturing or weeding (Gold, 1999). At a meeting on organic cultivating and confirmation sorted out by the Asian Institute of Technology (AIT) “applied natural farming” was introduced as a framework which utilizes normal materials, concentrates on humus administration and natural pest nuisance control and applies chemicals just when fundamental (Sapyaprapa, Chandrkrachang & Sombatsiri, 2002)

2.3 Organic Farming

Thailand's organic development was started by agriculturists and nearby NGOs in the 1980s. As the pessimistic effects of present day conventional agribusiness, for example, reliance on offfarm inputs, obligation of agriculturists or debasement of the earth expanded quickly, individuals were searching for contrasting options to the "green revolution" techniques. There was likewise an ascent of mindfulness concerning negative wellbeing impacts by agrochemicals, both for farmers and for shoppers. So the Alternative Agricultural Network was built up to encourage supportable cultivating works on, including organic farming (Panyakul, 2009).

In the eighth “National Economic and Social Development Plan” (covering the years 1997 to 2001) the Thai government announces organic horticulture as a noteworthy subject for the national agrarian arrangement. With the development of interest for organic nourishments in western nations, a business sector opportunity emerges: supply of tropical sustenances in organic quality. Since Thailand is a fundamental nourishment exporter, the administration saw a business sector specialty and upheld organic cultivating in Thailand, toward the starting mostly for fare (Panyakul, 2009). Till 2003 all ensured organic items were sent out.

2.3.1 The Organic Production

Using both traditional and exploratory information, organic farming frameworks depend on biological system administration instead of outer rural inputs. It is a framework that bars the utilization of engineered inputs, for example, manufactured manures and pesticides, veterinary medications, hereditarily altered seeds and breeds, additives, added substances and illumination. Organic horticulture is based upon an orderly approach and gauges that can be checked and are perceived universally.

2.3.2 Development of Thai Organic

Submitted on 30 August 2012, in light of the declining of horticulture because of unreasonable utilization of agro-chemicals and monetary weight, a gathering of ranchers and nearby non-government associations (NGOs) met up to build up the Alternative Agriculture Network (AAN) around the mid 1980s to cultivate supportable agribusiness

activism in Thailand. The AAN gives a talk gathering of experience sharing and arrangement backing for feasible agribusiness, including organic cultivating. This activity had excited interests among the concerned individuals to participate in the advancement of reasonable farming in numerous part of the nation as rustic improvement destinations. Organic cultivating is seen as a type of maintainable cultivating rehearses, together with agro-ranger service, blend cultivating, and regular cultivating. Then, the development of organic farming in EU and US, particularly the rise of business sector opportunities, has made some enthusiasm for agribusiness to start organic tasks with a specific end goal to catch the early market corner abroad. Organic homesteads in Thailand, as indicated by the foundation, and techniques, can be partitioned into 2 types as follows:

2.3.2.1 Self Sufficiency Oriented

These farms are generally having a place with little agriculturists who have been experiencing the green insurgency farming. They rehearse supportable incorporated cultivating, basically for independence economy for the family. Later, it was found that the differentiated cultivating advantages independence as well as improve soil and additionally edit assurance without concoction utilizing. It is consequently, these reasonable ranches are organicly achieved the organic cultivating standard.

2.3.2.2 Organic Standard Oriented

A large portion of recently began organic farms are told, by government authority, to entirely hone with both household and global organic benchmarks. Numerous farmers found that it is fairly troublesome and immoderate to conformingly with the organic farm standard, for example, developing trees as the fringe columns to keep the floating of shower from the field adjacent or to cease from utilizing water from the watering system framework which is not turned out to be free of substance deposits. In the wake of taking in the organic standard which they need to adjust with, a large portion of ranchers have surrendered directing organic homestead as they expected already. This is, at present, the most significant issue of organic ranch augmentation in Thailand. Ensured organic items are those which have been created, put away, prepared, took care of and advertised as per exact specialized details (guidelines) and certified as "organic" by a certification body. Once a certification body has verified conformity with organic standards, the product can be labeled as such. This name will contrast contingent upon the accreditation body, however can be taken as an affirmation that the crucial

components constituting a “organic” item have been met from the homestead to the business sector. Accreditation is a strategy by which a definitive body assesses and gives formal acknowledgment that an affirmation project is as per the guidelines of the legitimate body. For organic agribusiness, accreditation bodies can apply the deliberate universal principles and/or the national required benchmarks and be certify by the related “power”. At worldwide level, the International Organic Accreditation Service (IOAS) certifies affirmation bodies as indicated by IFOAM Accreditation Program criteria by conveying the “IFOAM Accredited” logo.

Thailand now-day, when contrasted with others created nations, is still at an early stage being developed on organic agrarian generation. In any case, the nation's organic division has become quickly in the course of recent years alongside the worldwide pattern, because of developing customer's wellbeing, and ecological concerns.

2.3.3 Standards and Certification by National Government

The administration has set up guidelines for organic harvest creation in 2000 and built up an accreditation body for organic items, called “Organic Thailand. It is overseen by the Department of Agriculture (DOA)/Ministry of Agriculture and Cooperatives (Chaivimol, 2003).

Pigure 2.1 State Label for Organic Products

2.3.4 Standards and Certification by NGOs

The first and only Thai certification body accredited by IFOAM is called "Organic Agriculture Certification Thailand" (ACT). This private organization was founded in 1995 and its members are NGOs, producer groups and other private organizations

Pigure 2.2 Label of ACT

The label of IFOAM (International Movement of Organic Agriculture Movements) is sometimes found on organic products in Thailand because it can be used by certification bodies accredited by IFOAM

Pigure 2.3 IFOAM Label

2.3.5 Regulations Concerning GMO

The business developing of hereditarily changed harvests or plants is not permitted in Thailand. For exploration purposes field trials with transgenetic plants are permitted yet authorization from the legislature is required (Valyasevi, Tanticharoen & Bhuniratana, 2003). Since May 2003 there is a direction for sustenance items containing hereditarily changed fixings. In the event that one of the principle three elements of a nourishment item has a GMO sullying of 5% or higher, it must be marked. Be that as it may, this is legitimate for soy and corn right now (Greenpeace, 2004). There have been

numerous challenges against GMO polluted sustenance items in Thai grocery stores and organic gatherings like Greenpeace are effectively battling for stricter controls.

2.3.6 Market Situation for Health Products in Thailand

Wellbeing attention to Thai urban shoppers is expanding, especially in regards to the abnormal state of pesticide use by Thai farmers and in this manner the likelihood of harmful buildups in sustenance. Diverse studies indicating elevated amounts of synthetic buildups on cabbages and foods grown from the ground daily paper articles have raised consideration among purchasers (IPM-Danida, 2003; Poapongsakorn, Ruhs & Tangjitwisuth 1998). The Ministry of Public Health has propelled a battle advising about chemicals and pesticides which expanded the interest for safe items. A study in 1991 researching the business sector potential for pesticidefree cabbages in Bangkok presumed that cabbage buyers had a negative view of pesticides and a high level of mindfulness concerning buildups. More than 80 percent of the respondents indicated enthusiasm for purchasing pesticide free cabbages (Nelson, 1991).

This shows there is a business sector potential for wellbeing items and distinctive items tending to these worries have as of now been presented by stores in Thailand.

Safe and Hygienic Products

A particular component of the neighborhood Thai nourishment business sector is the conjunction of various ecologically cordial, solid or hygienic names. There is frequently no unmistakable division of organic and "healthy" nourishment in the shops. Besides the names and the publicizing are comparable so shoppers can without much of a stretch be deceived (Panyakul, 2009).

Along these lines administrative foundations began distinctive confirmation frameworks for safe sustenance items. These projects and the marks having a place with them are clarified in beneath table.

Teble 2.2 Overview of Food Labels in Thailand and Their Definitions

Label	Name, issued by	Background
	'Hygienic fresh fruit and cabbage' Department of Agriculture/ Ministry of Agriculture and Cooperatives	The “hygienic fresh fruit and cabbage production project” was started in 1991 by the Department of Agriculture (DOA)/Ministry of Agriculture and Cooperatives (Chaimivol, 2003). In this program the use of agro-chemicals is regulated and controlled (IPM- DANIDA, 2003). The residues on the products have to be below a specific level that is safe for the consumer.
	'Pesticide-safe cabbages' Ministry of Public Health	The Ministry of Public Health assigns a label to retailers of agricultural products who conduct tests for toxic substances before selling the products (Tops, 2005). These products are from production systems using agro-chemicals but the residues have to be within the levels defined by the Ministry of Public Health.
	'Food Safety' Ministry of Public Health and Ministry of Agriculture and Cooperatives	The Ministry of Public Health and the Ministry of Agriculture and Cooperatives agreed on a common food safety logo which will replace the hygienic logo. Products are tested for residues and if they are below the Maximum Residue Level farmers and producers can use this certificate (IPM-Danida, 2003).

2.4 Organic Products

Agriculturists perceived that there may be a potential for household utilization of organic nourishments, particularly crisp cabbages and organic products. Rice, new products of the soil are the overwhelming societies become organicly in Thailand (Greennet & Earth Net Foundation, 2004). There is not really any organic animal's generation in light of the fact that there are no directions existing yet. New leafy foods, wild herbs and oats are the primary merchandise at the household organic business sector.

IFOAM evaluated proceeding with development patterns for the local organic business sector (Kung, 2004) and Rundgren (2003) said Thailand as a case for effective advancement of a nearby organic business sector. Though nearby associations see this business sector is contracting because of Thailand's monetary retreat (Greennet & Earth Net Foundation, 2004).

There are three principle dissemination diverts for organic items in Thailand grocery stores, specific shops and direct advertising (Panyakul, 2004).

In Bangkok a large portion of the general store chains offer organic items, however the scope of items relies on upon the area of the grocery store. All in all there is just little assortment of organic items accessible, the most well-known organic items are cabbages and rice.

2.5 Problem Identification

Nourishment quality is controlled by its dietary quality. Nourishing quality depicts the innate biological or wellbeing estimation of an item including the proportion of helpful to destructive substances as significance quality attributes administering shopper conduct. Buyers consistently ask whether organic items have wellbeing or quality points of interest. Organic cultivating cases to deliver higher quality than conventional farming. The creation procedures are an imperative piece of nourishment quality distinguished as 'procedure quality'. In these terms, the organic mark is not a wellbeing assert but rather essentially a procedure claim, including ecological effects and moral perspectives. It is deductively testing to enough survey the nourishment nature of

verdant cabbage developed utilizing diverse development techniques. Subsequently this developed meaning of healthful quality might be controlled by its substance, i.e. the whole of all fixings, valuable and unsafe mixes, and their nutritious viewpoints.

Organic cultivating is a developing area in Thailand which is supported by the legislature and numerous private activities (Chaimivol, 2004). In this manner the creation is relied upon to rise yet is there additionally a household market for organic items? The expansion of “healthy” sustenances and the foundation of testaments for hygienic or pesticide controlled cabbages shows that there is a potential business sector. Be that as it may, there are no real studies on the creation or utilization of organic sustenances.

There is an assortment of ecologically inviting and solid items available tending to customers' wellbeing concerns. This assorted qualities makes it troublesome for the customer to recognize the items and will bring about the inquiry “Why purchase organic food?” if the distinction is not traceable. A review of the Thai ranchers' exploration focus in 1996 on the wellbeing nourishment market demonstrated that there is an absence of trust in organic quality and that it's troublesome for shoppers to discover organic items (Panyakul, 2004).

It is an overall wonder that urban individuals turn out to be increasingly isolated from the cause of their sustenance (Kloppenburg, Hendrickson & Stevenson, 1996). Shoppers know next to no about the generation procedure, there is no recognizable proof with the item and its maker. This may be valid for the urban regions in Thailand also and consequently prompt a low level of trust in organic nourishment and security. It would demonstrate that there is insufficient data on the purchaser's side about organic generation. So it must be investigated the amount of information of organic cultivating purchasers as of now have and where they might want to be more educated.

The potential wellbeing dangers of human pesticide admission are very much concentrated on. Leafy cabbages are the principle wellspring of dietary pesticide. Additionally, the relative pesticide and microbial substance of organic versus expectedly created verdant cabbages is obscure in Pakchong Nakornrajsima.

2.6 The Role of Nutrition and Safety

Numerous customers see organic items as immaculate and less defiled with pesticides and in this manner as useful for their wellbeing. Organic agribusiness is a piece of a more beneficial way of life improvement which turns out to be more famous among buyers.

Buyers International, a purchaser association, sees organic horticulture giving diverse advantages to buyers, in particular ecological, wellbeing related and moral ones (Pedersen, 2003). Conservation of biodiversity, ground water insurance from pesticides, positive impacts on country and social advancement is case for ecological advantages (Pedersen, 2003).

Stanford study discovers little proof of medical advantages from organic nourishments, looking at the sustenance of organic and customary sustenances, there isn't much contrast.

2.7 Vitamins, Minerals and Antioxidants

Winter and Davis (2006) reported that it is too soon to attest that organic sustenance is superior to a routine one, as respects security and nourishing quality. Be that as it may, enthusiasm for organic items is becoming overall essentially in light of the fact that shoppers are worried about the measures of agrochemicals, pesticides, engineered development stimulants and anti-infection agents in sustenances, and also in hereditary adjustments (Torjusen, Lieblein, Wandel & Francis, 2001).

Some research work has prove nourishing contrasts amongst organic and traditional items, where these distinctions include fundamentally vitamin C content and the measure of sulfur-containing mixes (Worthington, 2001). Moreover, contrasts were likewise watched with respect to a few micronutrients, and a higher substance of nitrate was seen in items originating from routine development (Williams, 2002; Siderer, Maquet & Anklam, 2005; Davis, Epp & Riordan, 2004) thought about forty-three items (garden crops developed after conventional horticulture generation, without present day techniques) somewhere around 1950 and 1999. They discovered noteworthy contrasts

among six nourishing standards (proteins, calcium, potassium, iron, riboflavin and ascorbic corrosive), reporting a lower content in societies dated 1999. Creators credited this distinction (diminish in supplements) principally to cultivar choice by makers and not just to the development methods utilized as a part of the field.

2.8 Safety of Organic Products

Notwithstanding the constructive outcomes recommended in nourishment science writing of organic development, it has not been completely explained whether critical contrasts exist between sustenances delivered under organic and conventional development, specifically if there are adjustments in the concoction arrangement when sustenances are subjected to warm preparing, for example, cooking or delayed stockpiling. Moreover, organic creation needs a fabulous field taking care of, and the agriculturists need to focus for the most part to the materials utilized for organic compost (excrement), as a result of the high likelihood of microbiological pollutions (principally Escherichia coli, mycotoxins, coliforms, and so forth) and parasites. Continuous defilements can happen when the fertilizer creation procedure is not effectively did. As per Williams (2002), it has been recommended that the utilization of fertilizer and the lessened utilization of fungicides and anti-toxins in organic cultivating could bring about a more prominent sullying of organic sustenances by microorganisms or microbial items. Then again, up to now, no concentrates absolutely demonstrate that cabbages created taking after organic technique contain hurtful microorganisms to human wellbeing. Another point that ought to be considered, other than the opportune time of excrement application, is the cabbage cleaning strategy before the utilization. Another essential point is spoken to by the security of water utilized for watering system, the profound cleaning of the gear and the organic conditions after harvest, on the grounds that microbiological tainting can get basically from water. Just great agrarian practices, which ought to be asked for by national and global confirmed associations, can promise the security of the last item.

Inside the previous decade, various incredible audits have differentiated the nature of organic with customary nourishments. With two surveys specifically, differentiating conclusions were made: the audit by Lairon24 firmly bolstered the case that organic products of the soil are of higher dietary quality than routinely developed produce, though the one by Dangour et al. 25 presumed that there is practically no confirmation supporting such a distinction in nutrition quality.

2.9 Research about Organic Consumption in Thailand

As organic cultivating is still at an early stage in South East Asia there is just little research accessible about the buy of organic sustenance or the buyer's impression of organic. For Thailand two significant studies were distinguished. A review by Nelson (1991) investigated the business sector for without pesticide cabbages in Bangkok. There was a high attention to pesticide buildups and their negative impacts among the shoppers. Four gatherings of cabbage buyer were examined: the individuals who knew that pesticide free cabbages were sold and who had likewise purchased them, the individuals who knew however had not obtained without pesticide cabbages, the individuals who did not think about sans pesticide cabbages but rather would be occupied with purchasing them and the individuals who did not know and were not keen on purchasing pesticide free cabbages. The gatherings of real and potential buyer of without pesticide cabbages were described also instructed females with center or higher earnings. They specified to will to make bargains concerning the nature of these cabbages. They additionally expressed to will to pay higher costs for without pesticide items. The individuals who thought about pesticide free cabbages yet did not purchase them said the cost and the area of the stores where these items were sold as deterrents for purchasing. The overview additionally demonstrated that around half of the gathering of purchasers of sans pesticide cabbages perceived the bundling of these items, more than 80% of alternate gatherings did not perceive any of the bundles.

A study by the Thai Farmers Research Center in 1996 explored the business sector for contamination free/wellbeing sustenance in Bangkok. 62.3% of the 780 members had as of now purchased contamination free sustenance. 71.1% of the

respondents believed that devouring wellbeing nourishment would make them solid, 18.1% feared contamination in the sustenance (Panyakul, 2004). The primary impediments in purchasing wellbeing sustenance were: absence of trust in organic quality (applies for 61.2% of the interviewees), challenges to locate this sort of items (30.5%) and the cost (8.4%). 58.6% of the individuals who didn't purchase yet said the challenges to discover these items as primary impediment, 17.6% thought it was not important to purchase wellbeing nourishment (Panyakul, 2004).

2.10 Factors Affecting the Quality of Cabbage

The nature of cabbages relies on upon their quality at harvest, which changes amid the capacity. The most vital indicators of sustenance quality in cabbages quality are hereditary variables. The major preharvest variables, which impact on the nature of cabbages, are atmosphere, soil and administration rehearses.

The harvest assortment and hereditary properties majorly affect cabbage quality. Wholesome worth, taste, flavor and appearance are all identified with the assortment of yields. The variety in these components of nourishment quality is high. The most essential atmosphere variables influencing plant quality are light force, temperature and water accessibility. The impact of atmosphere on nutritious estimation of cabbages is accounted for in Salunke and Desai (1998) and Knorr and Vogtmann (1983). They report that higher light power builds vitamin C, B1 and beta carotene content in cabbages and organic product. Higher light power affects verdant green cabbages. Lee and Kader (2000) Sams (1999) and Kays (1999) talk about effects of atmosphere on sexy recognition. Light power amid development of organic product impacts shading. Abundance daylight, over the wavelengths utilized as a part of photosynthesis, and low temperature, diminish solidness and raise the quantity of imperfections in apples. Hail and high twist likewise on the grounds that imperfections in cabbages especially leave misfortune in verdant cabbages. A great deal of examination has discovered contrasts in supplement levels in cabbages, developed at different levels of nitrogen manure. These studies think about different levels of simulated, organic and blended compost. In any

case, not very many studies look at the impact of manure on nutritious nature of cabbages and organic product in organic and conventional creation.

Agricultural practices are distinctive organic and conventional development. The most critical contrasts are treatment practices and substance controls. This could bring about various quality between items from the two creation frameworks. Organic items may contain more vitamins and less concoction deposits. Generation technique causes contrasts in tactile parameters, notwithstanding, it is troublesome for shoppers to identify or assess these distinctions. The distinctions in supplement content and tangible parameters are little in correlation with contrasts brought about by atmosphere and soil sort. However, administration rehearses, between development frameworks, can even now affect the general sustenance nature of products of the soil.

CHAPTER 3

METHODOLOGY

3.1 Study Design

The independent study is observational, analyse study.

3.2 Sample for the Independent Study

Selection Criteria: Organic Farm Selection

We select Organic Farm, certified organic farm from IFOAM, at Pakchong Nakormrajsima.

Selection Criteria: Conventional Farm Selection

We select conventional farm on contiguous bundles of area up to 5 kilometers around organic farm. Contiguous area minimizes variability, wild verdure, water, soil, air and atmosphere, between tests, more noteworthy control over rural inputs.

Selection Criteria: Leafy Lettuce

Figurer 3.1 Leafy Lettuce

We select the leaf green lettuce plant (*Lactuca sativa*) that was caltivated under organic and conventional production systems in adjacent replicated plots during the winter 2013 at Pakchong Nakornrajsima. The organic plot was certified under IFOAM standard. The conventional system or traditional farming was initiated by farmers and not involve for any green revolution.

Green Lettuce (*Lactuca sativa*) is an annual plant of the daisy family Asteraceae. It is most often grown as a leaf vegetable, but sometimes for its stem and seeds. Lettuce was first cultivated by the ancient Egyptians who turned it from a weed, whose seeds were used to produce oil, into a food plant grown for its succulent leaves, in addition to its oil-rich seeds. Lettuce spread to the Greeks and Romans, the latter of whom gave it the name lactuca, from which the English lettuce is ultimately derived. By 50 AD, multiple types were described, and lettuce appeared often in medieval writings, including several herbals. The 16th through 18th centuries saw the development of many varieties in Europe, and by the mid-18th century cultivars were described that can still be found in gardens. Europe and North America originally dominated the market for lettuce, but by the late 20th century the consumption of lettuce had spread throughout the world.

Generally grown as a hardy annual, lettuce is easily cultivated, although it requires relatively low temperatures to prevent it from flowering quickly. It can be plagued with numerous nutrient deficiencies, as well as insect and mammal pests and fungal and bacterial diseases. L. sativa crosses easily within the species and with some other species within the Lactuca genus; although this trait can be a problem to home gardeners who attempt to save seeds, biologists have used it to broaden the gene pool of cultivated lettuce varieties. World production of lettuce and chicory for calendar year 2010 stood at 23 620 000/23,620,000 tonnes, half of which came from China.

Lettuce is most often used for salads, although it is also seen in other kinds of food, such as soups, sandwiches and wraps; it can also be grilled. Lettuce is a rich source of vitamin A and vitamin C. Contaminated lettuce is often a source of bacterial, viral and parasitic outbreaks in humans, including E. coli and Salmonella.

3.2.1 Sample Size

Sample in this study will use simple probability (random) sampling that will select 48 leafy lettuce plants from each organic and conventional farm to send to The

Institute of Nutrition, Mahidol University for analysis. This number refers from Janice E. Young., Phytochemical Phenolics in Organically Grown Vegetables. In Mol. Nutr.Food Res. 2005, 49, 1136-1142. Test weight use per 100g, both organic and conventional lettuce, for distinction diagnostic strategies.

3.2.2 Sample Procedure

During farm visit on June 2014, samples of leafy lettuce plant that was ready for harvest were picked randomly from different locations on the field and immediately put into sterile zip-lock bags without washing. The sample size for lettuces was 300 to 500 g or 8 plants per plot. We select by randomising 6 plots per field. The samples were then transported in boxes made of foam with ice placed on the bottom. Metal or wooden trays separated the ice from the bags containing samples. The temperature of lettuces was not monitored. The cooler boxes were delivered to The Institute of Nutrition, Mahidol University for analyses within 5 hrs after collection because quality is influenced by factors other than organic regulations such storage conditions.

3.3 Variables

3.3.1 Independent Variable

Leafy lettuce from Organic Farm

Leafy lettuce from Conventional Farm

3.3.2 Dependent Variable

Nutrition Properties: β-carotene, Vitamin C, Calcium, Phosphorus and dietary fiber

Physical Properties: Taste

Additives: Nitrate and nitrite

Microbial: Escherichia coli and Salmonella

3.4 Inclusion Criteria

Preharvest and Postharvest Factors, to be paired in both organically and conventionally grown production systems, that allow for a comparable produce quality study.

Preharvest

Organic site must be certified as organic/or strictly follow IFOAM protocols.

Conventional production protocols should adhere to current crop management standards similar soil qualities (e.g., mineral, organic matter, cation exchange capacity) identical previous crops or field with a similar history for all plots; utilized similar irrigation source, amount.

Postharvest

Wash/clean identically store for the same period of time, under identical atmospheres process under identical temperatures, humidities, and light (both intensity and quality) and time of day use identical analytical analyses and methods for quality determination.

3.5 Methods

Difference analytical processes and methods will be used in this study as below table.

Teble 3.1 Difference Analytical Processes and Methods will be used in this Study

Analysis	Methods
β-carotene	HPLC
Vitamin C	HPLC
Calcium	Atomic Absorption
Phosphorus	Gravimetric

Teble 3.1 (continued)

Analysis	Methods
Taste	
Nitrate and nitrite	ISO 3091: Colorimetric
Dietary Fiber	Enzymatic-gravimetric
Escherichia coli	BAM: Bacteriological Analytical Manual
Salmonella	ISO 6579

Source The Institute of Nutrition, Mahidol University

3.6 Data Analysis

To look at supplement substance of organic and conventional lettuce, we will utilize measurable techniques to recognize huge contrasts and patterns in the information.

Relative estimations of organic and conventional supplement substance were gone into a database for figuring. For every organic to-traditional examination, a percent distinction was computed:

(Organic - Conventional) / Conventional x 100.

For nutrients data, the t-test was used to identify significant differences in nutrient content as represented by the percent difference.

Assumptions

1. Each group is considered to be a sample from a distinct population.
2. The responses in each group are independent of those in the other group
3. Compare the calculated *t*-value, with *k* degrees of freedom, to the critical *t* value from the *t* distribution table at the chosen confidence level and decide whether to accept or reject the null hypothesis.

*Reject the null hypothesis when: calculated *t*-value > critical *t*-value and the result is significant at $p < 0.05$.

T-Test Calculator for 2 Independent Means

This test is used when we're looking at a numerical variable

Requirements

1. Two independent samples
2. Data should be normally distributed
3. The two samples should have the same variance

Null Hypothesis

H0: u1 - u2 = 0, where u1 is the mean of conventional lettuce and u2 the mean of organic lettuce.

As details above, the null hypothesis tends to be that there is no difference between the means of the two populations; or, more formally, that the difference is zero (so, for example, that there is no difference between the average nutritional and safety properties of two populations of organics and Conventionals).

CHAPTER 4

RESEARCH RESULTS

This section plans to give the consequence of the measurable examination: with a specific end goal to look at nutritient content amongst conventional and Organic lettuce. Firstly, a percent distinction was computed. Also, inferential insights incorporates t-test measurements was connected to recognize critical contrasts in supplement content. The crude information was broke down and deciphered by utilizing Statistical system.

4.1 Nutrition Quality and Harmful Microorganism Analysis

4.1.1 Dietary Fiber

Table 4.1 Comparison of Nutrition Content between Organic and Conventional Lettuce in Percentage

Nutrition	Conventional Cabbage			Organic Cabbage			%
	A	B	Mean	A	B	Mean	(Organic-Conventional)/Conventional x 100%
Dietary Fiber (g)	2.39	2.45	2.42	1.73	1.71	1.72	-28.93%
Soluble Dietary Fiber (g)	0.90	0.83	0.87	0.64	0.67	0.66	-24.14%
Insoluble Dietary Fiber (g)	1.49	1.62	1.56	1.09	1.04	1.07	-31.41%

Table 4.2 Comparison of Nutrition Content between Organic and Conventional Lettuce by using T-statistics Test

Nutrition	Conventional Cabbage			Organic Cabbage			t-value	p-value
	A	B	Mean	A	B	Mean		
Dietary Fiber (g)	2.39	0.45	2.42	1.73	1.71	1.72	2.13594	0.00102*
Soluble Dietary Fiber (g)	0.90	0.83	0.87	0.64	0.67	0.66	5.51487	0.01567*
Insoluble Dietary Fiber (g)	1.49	0.62	1.56	1.09	1.04	1.07	0.03599	0.0098*

Note. *p <0.05

From table 4.1 and table 4.2, the outcome demonstrates examination of dietary fiber content amongst organic and conventional lettuce in percentage and t-value as a follow:

Table 4.1, it found that mean of dietary fiber, solvent dietary fiber and insoluble dietary fiber substance of organic lettuce have less sum than conventional lettuce, where dietary fiber is 28.93% less, dissolvable dietary fiber is 24.14% less and insoluble dietary fiber substance is 31.41% less sum. The outcome from table 4.2 likewise shows critical distinctive of dietary fiber content amongst organic and conventional lettuce. Mean of dietary fiber substance of organic lettuce altogether less sum than conventional lettuce, where t-value of dietary fiber = 22.13594, (p = 0.00102), t-value of soluble dietary fiber = 5.51487, (p = 0.01567) and t-value of insoluble dietary fiber = 7.03599, (p = 0.00980) individually.

4.1.2 Vitamin and Mineral

Table 4.3 Comparison of Vitamin and Mineral Content between Organic and Conventional Lettuce in Percentage

Vitamin and Mineral	Conventional Cabbage			Organic Cabbage			% (Organic-Conventional)/ Conventionalx100%
	A	B	Mean	A	B	Mean	
Vitamin C (mg0	9.58	9.80	9.69	5.86	5.95	5.91	-39.01%
B-carotene (µg)	1,712.60	1,697.47	1,705.04	932.89	929.93	934.41	-45.37%
Calcium (mg)	47.51	49.29	48.40	43.48	45.07	44.28	-8.51%
Phosphorus (mg)	29.91	29.93	29.92	32.21	31.94	32.08	7.22%

Table 4.4 Comparison of Vitamin and Mineral Content between Organic and Conventional Lettuce by using T-statistics Test

Vitamin and Mineral	Conventional Cabbage			Organic Cabbage			t-value	p-value
	A	B	Mean	A	B	Mean		
Vitamin C (mg0	9.58	9.80	9.69	5.86	5.95	5.91	31.84723	0.00049*
B-carotene (µg)	1,712.60	1,697.47	1,705.04	932.89	929.93	934.41	100.36113	0.00005*
Calcium (mg)	47.51	49.29	48.40	43.48	45.07	44.28	3.45661	0.03723*
Phosphorus (mg)	29.91	29.93	29.92	32.21	31.94	32.08	15.91935	0.00196*

Note. *p <0.05

From table 4.3 and table 4.4, the result shows comparison of vitamin and mineral content between organic and conventional lettuce in percentage and t-value as a follow:

Table 4.3, it found that mean of Vitamin C, B-carotene and Calcium content of organic lettuce have less amount than conventional lettuce, except phosphorus content has more amount than conventional lettuce. Where vitamin C content is 39.01% less, B-carotene content is 45.37% less and calcium content is 8.51% less, except phosphorus content of organic lettuce is 7.22% more than conventional lettuce. The result from table 4.4 also indicates significant different of vitamin c, B-carotene,

calcium and phosphorus content between organic and conventional lettuce. Mean of vitamin c content of organic lettuce significantly less amount than conventional lettuce, where t-value of vitamin c = 31.84723, (p = 0.00049), t-value of B-carotene = 100.36113, (p = 0.00005), t-value of calcium = 3.45661, (p = 0.03723) and t-value of phosphorus = 15.91935, (p = 0.00196) respectively.

4.1.3 Additive Group

Table 4.5 Comparison of Additive Content between Organic and Conventional Lettuce in Percentage

Additive Group	Conventional Cabbage			Organic Cabbage			% (Organic-Conventional)/ Conventional x 100%
	A	B	Mean	A	B	Mean	
Nitrate (mg/kg)	0.18	0.42	0.30	3.54	2.73	3.14	946.67%
Nitrite(mg/kg)	0.12	0.12	0.12	0.01	0.01	0.01	-91.67%

Table 4.6 Comparison of Additive Content between Organic and Conventional Lettuce by using T-statistics Test

Additive Group	Conventional Cabbage			Organic Cabbage			t-value	p-value
	A	B	Mean	A	B	Mean		
Nitrate (mg/kg)	0.18	0.42	0.30	3.54	2.73	3.14	6.71159	0.01074*
Nitrite(mg/kg)	0.12	0.12	0.12	0.01	0.01	0.01	Infinity	<0.00001*

Note. *p <0.05

From table 4.5 and table 4.6, the result shows comparison of additive content, nitrate and nitrite, between organic and conventional lettuce in percentage and t-value as a follow:

Table 4.5, it found that mean of nitrate content of organic lettuce has more amount than conventional lettuce, but nitrite content has less amount than conventional lettuce. Where nitrate content of organic lettuce is 946.67% more than of

conventional cabage, but nitrite content is 91.67% less. The result from table 4.6 indicates significant different of nitrate content between organic and conventional lettuce. Mean of nitrate content of organic lettuce significantly shown more amount than conventional lettuce, where t-value of nitrate content = 6.71159, (p = 0.01074). But t-value of nitrite content is infinity, where it means that it is insignificantly different.

Nitrogen is the principle restricting component for most field yields, and nitrate is the real type of nitrogen consumed by yield plants. Agriculturists regularly utilize nitrogen manures to build crop yields. Subsequently, numerous vegetables and scavenge crops aggregate large amounts of nitrate. Specifically, verdant vegetables, for example, spinach, lettuce, and celery contain nitrate at noteworthy levels (Maynard, Barker, Minotti & Peck, 1976). Leaf and stem tissues aggregate the most nitrate, trailed by roots (Lorenz, 1978). Nitrite content in vegetables is generally low contrasted with nitrate (Aworh, Hicks, Minotti & Lee, 1980; Chase & Turner 1994). Vegetables are for the most part considered the biggest wellspring of dietary nitrate. In the normal US diet, vegetables contribute 87% of the aggregate every day admission of nitrate. Nitrate is additionally shaped by endogenous blend in the human digestive system (Tannenbaum, Fett, Young, Land & Bruce, 1978).

The potential wellbeing dangers of nitrate and nitrite are very much considered. Nitrate can by and large be thought to be of generally lower lethality than nitrite. In any case, around 5% of dietary nitrate is changed over to nitrite in people by bacterial and mammalian metabolic pathways (Walters & Smith, 1981). Conceivably cancer-causing N-nitroso mixes can then be framed from nitrite and N-nitrosatable mixes endogenously. Nitrate admission may bring about methemoglobinemia (too known as “blue child sickness”), which can be troublesome in babies under three months of age, in spite of the fact that it is immaterial in grown-ups. As of late, a positive part of nitrate in the human body's protection against pathogenic microscopic organisms has been examined (Duncan et al., 1997). Detail of nitrate toxicity, and Gangolli et al. (1994) as below.

Guide and Maximum Tolerated Nitrate Concentrations of Vegetables (mg NO_3 kg^{-1} in fresh weight)

Vegetable	Germany (Guide)	Netherlands (Maximum)	Switzerland (Guide)	Austria (Maximum)	Russia (Maximum)	EC (Maximum)
Lettuce	3000	3000(S) 4500(W)	3500	3000(S) 4000(W)	2000(O) 3000(G)	3500(4-10) 4500(11-3) 2500(O,5-8)
Spinach	2000	3500(S) 4500(W) 2500(1995)	3500	2000(<7) 3000(>7)	2000(O) 3000(G)	2500(4-10) 3000(11-3) 2000(P)
Red beet	3000	4000(4-6) 3500(7-3)	3000	3500(S) 4500(W)	14000(O)	
Radish	3000			3500(S) 4500(W)		
Endive		3000(S)		2500(S)		
Cabbage			875	1500	900(S) 500(W)	
Carrot				1500	400(S) 250(W)	

S:summer. W:winter. O:outdoor. G:greenhouse. P:processed product (preserved/frozen). <7:harvest by the end of June. >7:harvest from July. 1995: from 1995. 4-10:1 April to 31 October. 11-3:1 November to 31 March. 5-8:1 May to 31 August.
Data from Scharpf 1991(cited from Sohn and Yoneyama 1996) and MAFF UK (1999).

Figurer 4.1 Detail of Nitrate Toxicity

4.1.4 Microbial Group

Table 4.7 Comparison of Microbial Content between Organic and Conventional Lettuce

Microbial Group	Conventional Cabbage			Organic Cabbage		
	A	B	Mean	A	B	Mean
Escherichia coli / g	Less than 3			3.00	3.00	3.00
Salmonella spp. / 25g	Not detected			Not detected		

From table 4.7, the result can not compare the different of microbial content, Escherichia coli and Salmonella spp., between organic and conventional lettuce because the results of Escherichia coli content of conventional lettuce is less than 3 /g and content of organic lettuce is 3/g. Then it could not summay the result significantly different or not. And Salmonella spp. content of these two kinds of lettuce also could

not summary because the testing device could no detected the content amount of Salmonella spp.

4.2 Hypothesis Testing

4.2.1 Hypothesis 1

Hypothesis 1: Organic leafy lettuce has more nutrient content than conventional leafy lettuce by an analytical amount.

From table 4.1, 4.2, 4.3 and 4.4, research results shown that Organic leafy lettuce has significantly less nutrient content than conventional leafy lettuce. Then the hypothesis 1 was unsupported.

4.2.2 Hypothesis 2

Hypothesis 2: Organic leafy lettuce is not having more harmful compounds than conventional leafy lettuce by an analytical amount.

From table 4.5, 4.6 and 4.7, research results can not obviously summary that organic lettuce had more harmful compounds than conventional lettuce or not. Then the hypothesis 2 was no concluion.

CHAPTER 5

CONCLUSION, DISCUSSION AND SUGGESTION

5.1 Conclusion

In this section, t-statistics was tested in order to compare nutritient content between conventional and organic lettuce. Conventional lettuce was selected from conventional farm on adjacent parcels of land up to 5 kilometers around organic farm at Pakchong, Nakornrajsima. The organic farm was certified under IFOAM standard. In this study, researcher selected the leaf of lettuce plant, which was caltivated under organic and conventional production systems. Sample in this study were sent to The Institute of Nutrition, Mahidol University to analysis within 5 hrs after collection.

5.1.1 Nutrition Quality and Harmful Microorganism Analysis

5.1.1.1 Dietary Fiber

Dietary fiber including dietary fiber, soluble dietary fiber and insoluble dietary fiber content of organic lettuce has fewer amounts than conventional lettuce significantly.

5.1.1.2 Vitamin and Mineral

Vitamin c, B-carotene and calcium content of organic lettuce have significantly less amount than conventional lettuce, except phosphorus content has more amount than conventional

5.1.1.3 Additive Group

Additive substances including nitrate and nitrite content shown conversely result. Nitrate content of organic lettuce has more amount than conventional lettuce; on the other hand nitrite content has fewer amounts than conventional lettuce.

5.1.1.4 Microbial Group

The lab test result can not compare the different of microbial content, Escherichia coli and Salmonella spp., between organic and conventional lettuce.

5.1.2 Results and Prove of Hypothesis

Hypothesis 1: Organic leafy lettuce has more nutrient content than conventional leafy lettuce by an analytical amount. The result indicated the significant difference between nutrient content of organic lettuce and conventional treatment. The percentage and t-statistics show dietary fiber, vitamin and mineral content of conventional lettuce have significantly more than organic lettuce. The hypothesis 1 was rejected.

Hypothesis 2: Organic leafy lettuce has more harmful compounds than conventional leafy lettuce by an analytical amount. The result indicated the significant difference between additive substances content of organic lettuce and conventional treatment. The percentage and t-statistics show nitrate content of conventional lettuce have significantly less than organic lettuce. But for nitrite percentage content is adversely and t-statistics is infinity. The hypothesis 2 is no conclusion.

5.2 Discussion

Because of shoppers buy organic lettuce for some reasons. The across the board recognition that organicly created lettuce is more nutritious than conventional options; we didn't discover hearty confirmation to bolster this observation. From the supplements assessed, just 1 comparison, the phosphorus substance of lettuce, showed the prevalence of organic lettuce (contrasts were measurably huge and homogenous), Higher levels of phosphorus in organic produce lettuce than in conventional lettuce is unrealistic to be clinically huge on the grounds that close aggregate starvation is expected to deliver dietary phosphorus insufficiency.

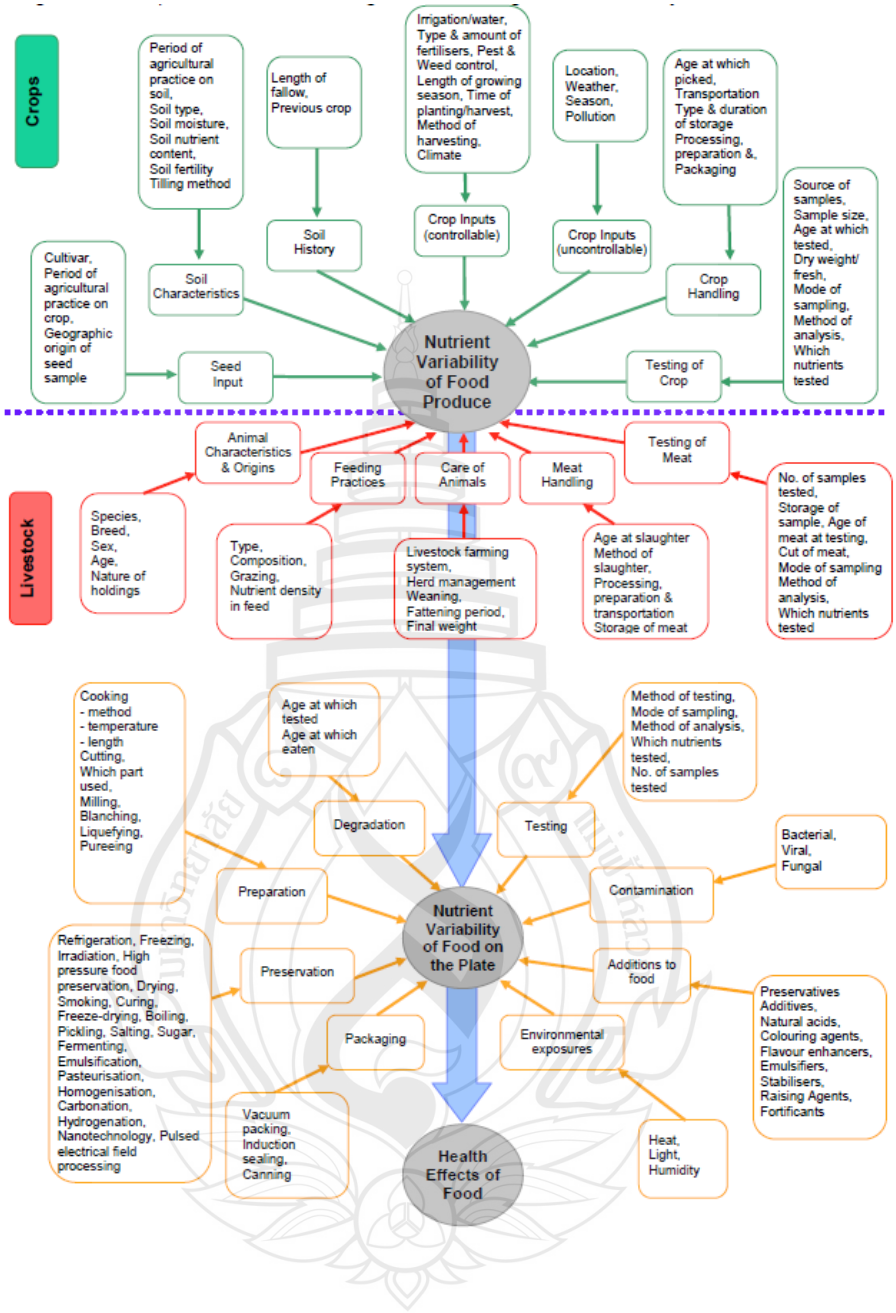
The study has some extra key discoveries. It is found no distinction in the danger for tainting of produce with pathogenic microscopic organisms. Both organic and conventional items were usually debased with Salmonella and Escherichia coli.

The consistent idea among distributed organically versus conventionally create studies is the gigantic variability in the introduced information. This muddles

understanding of the discoveries and makes it hard to exhibit convincing contrasts. In verging on each study in which cases of vast healthful and tangible quality contrasts were made amongst organically and conventionally deliver, the experimenters unmistakably neglected to control or to “match up” comparative ecological and cultivar inputs that influence plant improvement, yield, and quality. This study was the first to address this uniqueness of satisfactorily controlled correlation concentrates on and highlighted the most appalling issue: examination testing direct field-inspecting reviews. This concentrate additionally tended to coordinating or “blending” creation procedures of organically and conventinally developed produce. Matching regular creation variables, for example, the organic, physical, and compound/nourishing centralizations of soil sorts, watering system sources and sums, crop cultivars, crop developments and harvest dates, and pre-and postharvest taking care of, handling and capacity strategies will, independently and by and large, influence variability and any noteworthiness the inputs remarkable to organic and conventional frameworks may have on item quality.

This study introduces the consequences of contrasts in supplement substance of organically and conventionally delivered lettuce. The organic development has a long history, and the huge extent of articles recognized distributed after 2000 highlights the abnormal state of current investigative premium. The examination exhibited recommends that organiclally and expectedly created nourishments are similar in their supplement content. For supplement classes examined, there were no critical contrasts between generation strategies. Contrasts that were identified in yields were organically conceivable and were in all likelihood because of contrasts in manure use (nitrogen and phosphorus) and readiness at harvest. It is impossible that utilization of these supplements at the fixations reported in organic sustenances in this study give any medical advantage. A vital end product is that organicly created nourishments are not second rate compared to customarily delivered sustenances as for their supplement content. This study varied from past studies in a few viewpoints. Organic and customary lettuce were developed one next to the other on a controlled and affirmed organic creation office, dispensing with the inclination instigated by uncontrolled ecological elements that may have affected results.

The present investigation proposes that a little number of contrasts in supplement content exist amongst organiclally and conventionally delivered and that, while these distinctions in substance are organically conceivable, they are unrealistic to be of general wellbeing significance. One wide decision to make is that there is no confirmation to bolster the choice of organically delivered lettuce over conventionally created lettuce to expand the admission of particular supplements or nutritiously applicable substances. It is likewise clear that exploration around there would advantage extensively from more prominent exploratory meticulousness and a superior comprehension of the different variables (aside from generation regimen) that decide the supplement substance of lettuce. An understanding of the various factors that affect nutrient variability in crops and livestock products is important for the design and interpretation of research in this area, and it should also serve to identify critical gaps in our knowledge and thus the intrinsic limitations of any analysis. An intuitive conceptual framework highlighting some of the factors that contribute to the variability in nutrient content in crops, livestock products and processed foods is presented as below.



Source Dangour et al. (2009)

Pigure 5.1 Livestock Products and Processed Foods is Presented

5.3 Suggestions

Taking everything into account, there is the reasonable need to enhance examines about on the contrasts amongst organic and conventional lettuce. This errand ought to be precisely expert, considering that few elements can change the nutritious nature of a nourishment, for example, crop time, atmosphere, soil attributes, and ecological conditions. Taking into account the autonomous study a relative of nutitional quality in leafly lettuce from organic and conventinal plant-based at Pakchong, the analyst might want to reason the accompanying proposals.

5.3.1 This study inquired about on leaf lettuce lettuce as it were. There ought to be more research studies on other sort of lettuces to examine huge of supplement substance.

5.3.2 As this independent study researched examined on supplement substance of dietary fiber, some sort of added substance substances, vitamin and mineral (nitrate and nitrite) and some microbials. There ought to be more research study on other harmful substance and pesticide to discover the critical unsafe substance content between organic lettuce and conventional lettuce. Organic yields, which are not showered with manufactured pesticides, were essentially accepted to have more elevated amounts of phenolics due to higher creepy crawly and sickness weights. Furthermre, under these controlled developing conditions, no study on the distinctions in levels of individual and aggregate phenolics amongst organically and conventionally. The responsive of bug assault, organic examples ought to created larger amounts of aggregate phenolics than customary specimens, proposing that creepy crawly assault may be biotic anxiety variables which achieve the more elevated amounts of aggregate phenolic specialists in some lettuces from organic generation frameworks.

5.3.3 This study looked into inside just 1 season. There ought to be more research studies in other month or season, so as to analyze the distinction results between every season.

5.3.4 Essentially, the fate of organic versus customary studies ought not be restricted to measures of produce quality contrasts, however should concentrate on soil ripeness/plant root collaborations and controlling bacterial and mycotoxin

contaminants, particularly in organic produce, and postharvest systems to look after quality. Moreover, human-phytonutrient bioabsorptivity thinks about need to figure out whether elevated dietary quality contrasts likewise have uplifted human-medical advantages. Right now there are no immediate studies exhibiting human-medical advantages from organicly versus customarily developed sustenance. Be that as it may, particular human bioactive supplements and contaminants can be ascribed to organic versus conventional produce, and when higher utilization examples of the organic produce shopper are viewed as, expanded particular supplements and contaminants in people is watched.

5.3.5 In general wellbeing terms, there is insufficient confirmation to suggest customary over organic lettuce. The general higher lettuce utilization of organic contrasted with conventional purchasers exceeds more often than not the part of contrasts in supplement and contaminant fixations amongst organic and conventional lettuce.

5.3.6 Finally, in light of the fact that the information gathered to date recommend that there are genuine contrasts in supplement content between customary harvests and organic, more research into the relative wellbeing impacts is surely all together. Next, an endeavor was made to evaluate how these distinctions in supplement substance could influence a man's day by day supplement admission. Assessments of the supplement substance of the lettuce partition a day by day menu were made for both a organic and a conventional eating conventional. We propose that there ought to have long haul investigations of wellbeing results of populaces expending dominatingly organic versus conventionally produced.

5.3.7 From Ecological criteria of food quality (Vogtmann, 1991) there are more criteria to consiser as follows:

Technological Value. A technological value of food products refers to their distinctive features in the light of requirements of different interest groups.

Sensory Quality. Sensory quality includes such features of a product which are assessed by a human by the means of special tests and the organs of taste, smell, touch, sight and hearing.

Nutritional Value. Vitamins, phenolic compounds and mineral compounds. The nutritional value of food depends mainly on it having the appropriate content of compounds necessary for the proper functioning of the human body.

Nitrates and nitrites. Nitrates are essential nutrients for plant growth. In the organic system, organic fertilizers (compost, manure) are used; these also include nitrogen, but it is organically-bound. When it is necessary, nitrogen compounds are absorbed by plant from the humus in a specific quantity, therefore, there is marginal possibility of excessive nitrates accumulation in plant organs.

Pesticides (herbicides, fungicides, insecticides). In agriculture, herbicides are used to kill unwanted plants, fungicides against fungal diseases and insecticides to protect plant against pests.

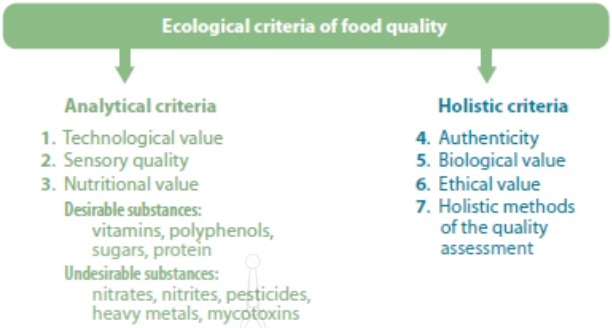
Contamination with natural fertilizers and zoonotic bacteria

Authenticity. An authenticity criterion of food product may be interpreted in the ways of there is traceability, i.e. the ability to check whether the characteristics of the product examined actually correspond with the features attributed to it. On route, products can lose their authenticity. Consequently, many consumers seek minimally processed products, from familiar and safe sources.

Biological Value. The biological value of food identifies how food influences human and animal health; it derives from the holistic approach towards food quality and the belief that it is not sufficient to know the chemical composition of food to determine dependence between the food consumed and human and animal health.

The whole product means more than the total of its separate components; a product has an effect on the whole human body (proportions and interactions between particular substances).

Ethical Value. The ethical value of food quality is made up of three aspects: environmental impact, social and economic aspects and animal welfare. One of the main factors affecting product quality is the quality of the environment.



Pigure 5.2 Ecological Criterial of Food Quality

Ecological criteria of food quality are much wider than strictly analytical. They comprise not only the composition of the food, but also the production system in its environmental, social and ethical context.

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REFERENCES

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APPENDIX

APPENDIX

RESULTS OF THE TEST SAMPLE

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ห้องปฏิบัติการ สถาบันโภชนาการ มหาวิทยาลัยมหิดล
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รายงานผลการทดสอบ

ตัวอย่างอาหาร : Organic Cabbage

เลขที่บริการ : SFC,SST,SFT 1159/2557

รายละเอียดของตัวอย่างอาหาร : เป็นผักสดสีเขียวอ่อน บรรจุถุงพลาสติก จำนวน 3 ถุง (ไม่มีฉลาก)

ผู้ขอรับบริการ : ผู้ช่วยศาสตราจารย์ ดร. ชนิดา ปโชติการ
สถาบันโภชนาการ มหาวิทยาลัยมหิดล

วันที่รับตัวอย่าง : 23 มิถุนายน 2557

วันที่ทดสอบตัวอย่าง : 24 มิถุนายน 2557

ผลการทดสอบ : (ต่อ 100 กรัม)

	A	B
Dietary fiber (g)	1.73	1.71
Soluble dietary fiber (g)	0.64	0.67
Insoluble dietary fiber (g)	1.09	1.04
Vitamin C (mg)	5.86	5.95
β-carotene (µg)	932.89	929.93
Calcium (mg)	43.48	45.07
Phosphorus (mg)	32.21	31.94
Nitrate (mg/kg)	3.54	2.73
Nitrite (mg/kg)	0.01	0.01
Taste	ชม	
Microbiological Examination :		
Escherichia coli/g	3	
Salmonella spp./25 g	Not detected	

(ผู้ช่วยศาสตราจารย์สิริมา จิตตินันทน์)
รองผู้อำนวยการฝ่ายนโยบายและพัฒนาคุณภาพ
ปฏิบัติหน้าที่แทน ผู้อำนวยการสถาบันโภชนาการ

รายงานผลการทดสอบ ตามหนังสือเลขที่ ศร 0517.21/11[illegible] ลงวันที่ 30 กรกฎาคม 2557

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รายงานผลการทดสอบ

ตัวอย่างอาหาร : Conventional Cabbage

เลขที่บริการ : SFC,SST,SFT 1160/2557

รายละเอียดของตัวอย่างอาหาร : เป็นผักกลดสีเขียวอ่อน บรรจุถุงพลาสติก จำนวน 6 ถุง (ไม่มีฉลาก)

ผู้ขอรับบริการ : ผู้ช่วยศาสตราจารย์ ดร. ชนิดา ปโชติการ
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วันที่รับตัวอย่าง : 23 มิถุนายน 2557

วันที่ทดสอบตัวอย่าง : 24 มิถุนายน 2557

ผลการทดสอบ : (ต่อ 100 กรัม)

	A	B
Dietary fiber (g)	2.39	2.45
Soluble dietary fiber (g)	0.90	0.83
Insoluble dietary fiber (g)	1.49	1.62
Vitamin C (mg)	9.58	9.80
β-carotene (µg)	1,712.60	1,697.47
Calcium (mg)	47.51	49.29
Phosphorus (mg)	29.91	29.93
Nitrate (mg/kg)	0.18	0.42
Nitrite (mg/kg)	0.12	0.12
Taste	ขม	
Microbiological Examination :		
Escherichia coli/g	Less than 3	
Salmonella spp./25 g	Not detected	

(ผู้ช่วยศาสตราจารย์สิดิมา จิตตินันทน์)
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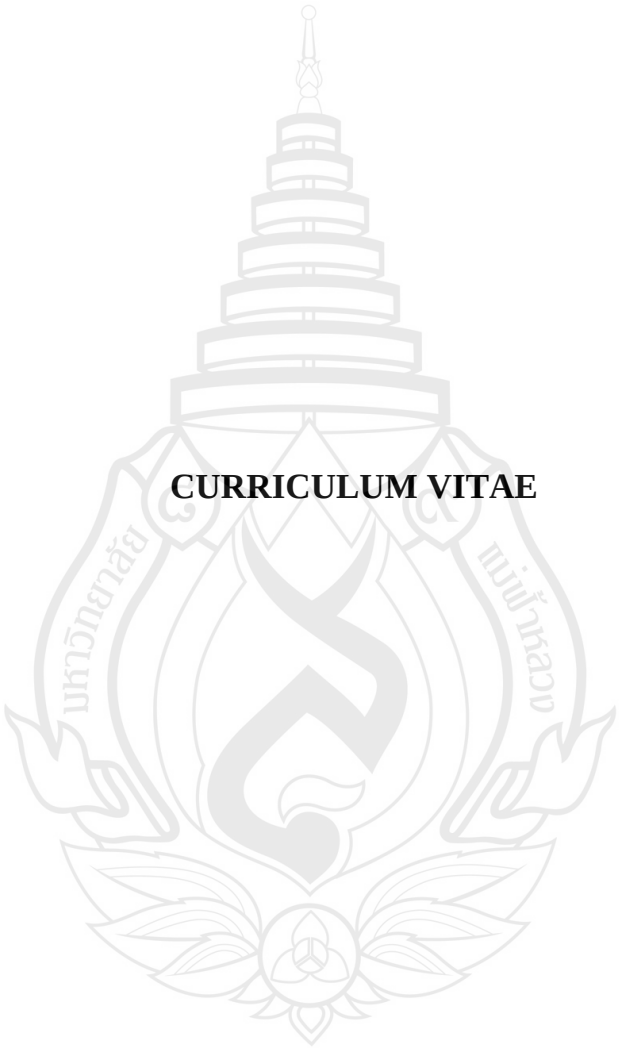

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