東海大學餐旅管理學系碩士論文

以計畫性行為理論探討台灣銀髮族之飲食多樣化攝取

Using The Theory Planned Behavior to Understand Dietary Diversity among Older Taiwanese Adult

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終於寫到誌謝這部分，多麼感動的一刻，是時候讓這階段的探索生涯告一段落了。

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鄭羽萱 謹致於

私立東海大學餐旅管理研究所

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以計畫性行為理論探討台灣銀髮族之飲食多樣化攝取

中文摘要

近年來，高齡化人口的快速成長，之前的研究顯示銀髮族的飲食缺乏多樣性，而飲食多樣化有助於改善銀髮族營養狀況及維持身體狀態，由此可知，在銀髮族這個群體的飲食多樣性更應被重視。普遍將飲食多樣性定義為每一類食物的組合被食用於某一特定時間內，分別有全穀根莖類、蔬菜類、豆魚肉蛋類、油脂與堅果種子類、乳製品類和水果類共六類。此外，飲食多樣性分數可作為衡量飲食品質高低的關鍵要素同時也是一個簡單的食物指標能預測死亡率。為了解影響飲食多樣化行為的因素，因此本研究以計劃性行為理論結合飲食多樣化，探究態度、主觀規範及知覺行為控制對台灣銀髮族之飲食多樣化攝取的影響因素。本研究以55歲以上且居住在台灣中部的銀髮族為研究對象，至16個銀髮族活動地點發放471份問卷，其中有效問卷406份，有效回收率達86.2%。本研究結果顯示大多數研究對象為女性，年齡介於65-74之間，與家人同住并在一天中有兩餐是自己煮，飲食多樣性分數均達到6分。相對於其他5個食物組合，銀髮族對於乳製品類呈現低攝取。回歸分析結果顯示主觀規範對多樣化行為影響最大其次是知覺行為控制，但態度的影響則不顯著，整體的解釋力為6.2%。結論，台灣銀髮族在飲食多樣化的行為上主要受到專業人士，社區和家人的支持使他們能高度的多樣性飲食而知覺行為控制則顯示牙齒不好、購買麻煩及過量採買會降低食物多樣性的攝取。可見應鼓勵他們參與團體活動，能取得更多有關於健康飲食的正確訊息透過專業人士導正對於感知到飲食多樣化的阻礙，而態度的不顯著影響行為可能是因為銀髮族傾向於重視他人的想法勝於自己的想法。這些研究結果提供給政府單位發展相關政策及業者就此趨勢促進台灣銀髮族健康的生活形態。

關鍵字：態度、飲食多樣化、台灣銀髮族、知覺行為控制、主觀規範

Using Theory of Planned Behavior to understand dietary diversity on Taiwanese elderly

ABSTRACT

The number of elderly population has grown fast. The previous studies showed that lack of variety in the foods they eat among older adult moreover dietary diversity can help them to improve nutritional status and to preserve body mass. It can be seen, older adult is necessary to variety of diet. Dietary diversity is defined as the number of individual food groups which are consumed over a specific period and universally identified as key element with high quality diet as well as a simple food index as good as predictive for mortality. The main purpose of this study is to use theory planned behavior to examine consumption of a varied diet among older Taiwanese adults affected by attitudes, subjective norms and perceived behavior control to understand the cause of behavior. The subjects of this study who aged above 55 years living in Centre Taiwan were sampling and total of 406 usable samples yielded from 16 data collection sites. The results of this study was found that most are women, age range for 65-74 years old, living with family member as well as food prepare by myself for 2 meals a day were achieve higher DDS. Only the dairy product was lower intake difference with other 5 food group. Regression analysis revealed that SN was most important in explaining DDS followed by PBC and attitude did not. Overall three measurements of explanation by 6.2%. In conclusion, important encouraged by professional, community and family members to increase eating a variety in diet whereas older Taiwanese adult felt barrier PBC related to bad teeth, buying overload and purchase inconvenience still reduce their food intake. It can be seen, should encouraged they more to participate community activities will update the useful information was true about dietary diversity through professional that might weaken barrier of PBC. And that, one of the reason by older adult perform behaviors that others think important may lead to attitude not effect on DDS. Finally, these results enable the development of relevant strategies to facilities older Taiwanese adult to healthy lifestyle.

Keywords: attitude, dietary diversity, older Taiwanese adults, perceived behaviour control, subjective norm

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CHAPTER 1 INTRODUCTION

World Health Organization (WHO) indicated that globally is rapidly aging. Furthermore, between 2000 and 2050, the number of the world's population over 60 years will double from about 11% to 22%, from 841 million people in 2013 to more than 2 billion in 2050. Therefore, Taiwan is one of the countries with a rapid aging population as well as this is a group cannot be ignored. In recent year, nutrition risk make people are starting realized that source of ingredient and beginning takes several measures to preserve and improve their health. For example, Bugera, Lengyel, Utioh, & Arntfield, (2013) result show that 86% of the baby boomer population consumed six to seven home cooked meals in a week. Elderly are particularly vulnerable to malnutrition. Many of the diseases suffered by older persons are the result of dietary factors, some of which have been operating since infancy due to elderly people a lack of variety in the foods they eat (WHO, 2002). Fewer studies have shown that higher fruits and vegetables variety reduced the risk of type 2 diabetes and some cancers, independent of quantity of intake (Cooper et al., 2012; Jeurnink et al., 2012).

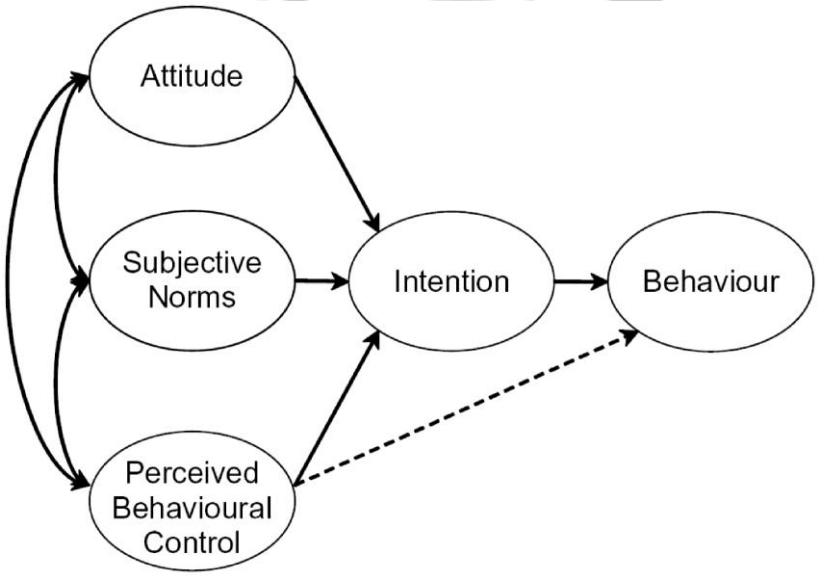

Figure 1. The Theory of Planned Behavior adapted by Ajzen, 1991

Human attitudes and behavior have been attracting growing attention in the field of social psychology. The theory of planned behavior (TPB) is an extension of the theory of reasoned action (TRA) (Azjen and Fishbein, 1980; Ajzen, & Madden, 1986). TRA proposed by Fishbein, & Ajzen, (1975) suggested that behaviors could be predicted by measuring attitude. In additional, attitudes and subjective norms could affect behavioral intentions. In order to extended the TRA to cover non-volitional behaviors for predicting intention and actual behavior. Hence, in a study by Ajzen (1991) was showed that development the TPB to increases the predictive power of the TRA by adding perceived behavioral control and it was considers volitional control as a variable. In consequence, TPB uses a person's individual motivational factors to predict the performance of a specific behavior. Therefore, intention is directly driven by three major constructs attitude, subjective norm, and perceived behavior control and the stronger the intention, the more likely an individual will perform the behavior (Ajzen, 1991), see Figure 1. This model provides a framework for the determination and analysis of behavioral, normative, and control beliefs that impact health behaviors (Ajzen, 1991; Armitage & Conner, 2001; McEachan, Conner, Taylor & Lawton, 2011). Many researches were carried out TPB model to predict the diet of health behaviors. For example, the findings indicate that multiple attitudinal, normative, and control factors influence healthful dietary behavior in adolescents (Backman, Haddad, Lee, Johnston, & Hodgkin, 2002). Hence, this study carry out theory of planned behavior in order to explanation human dietary behavior.

On the other hand, dietary diversity is defined as the number of individual food groups or food items which are consumed over a specific period (Ruel, 2003) and universally identified as key element with high quality diet as well as nutrient adequacy (Savy, Martin-Prével, Sawadogo, Kameli, & Delpeuch, 2005). In additional,

dietary diversity often association with dietary variety, actually dietary variety is focus on number of food (Keding, Msuya, Maass, & Krawinkel, 2012) and that Dietary Variety Score (DVS) counted the total number of foods consumed on a regular basis (Drewnowski et al., 1996) but dietary diversity is wide of food groups as well as should not be confused with food quantity. In consequence, avoid nutrition risk based on dietary diversity become omnivores as well as balanced diet (Burgess, & Glasauer, 2004). In additional, some studies have showed that high intake of fruits and vegetables particularly high variety reduces the risk of different chronic diseases and cancer (Boeing et al., 2012; World Cancer Research Fund & American Institute for Cancer Research, 2007), nevertheless, intake is far below recommendations among adults (Mensink et al., 2013) as well as among children (Hilbig et al., 2011). Study by Acham, Oldewage-Theron, & Egal, 2012 was showed that eggs, legumes, and least consumed by rich in vitamin A as fruit and vegetables and the older age groups being at risk of low micronutrient intake, particularly in calcium, vitamins C and A. While advancing age the risk of developing chronic illnesses increases but dietary diversity can help older adult reduce risk of chronic diseases to maintain their physical fitness. Thus, older adult were more likely through exercise than diet and compare with young adult to actively manage their diabetes (Munir et al., 2009). By this taken, dietary diversity is need for older adults this population.

Previous studies have conducted the separate of theory of planned behavior association health diet and dietary diversity is related to nutrient adequacy if dietary diversity score was high. However, little research has been done on combination both of TPB model and dietary diversity to explore factors affecting older Taiwanese adult to varied diet.

Purpose of this study

The main purpose of this study, using the theory of planned behavior (TPB) to examine consumption of a varied diet among older Taiwanese adults affected by attitudes, subjective norms and perceived behavior control to understand the cause of behavioral actions**.** Subsequently, this study applying Dietary Diversity Score (DDS) to understand older Taiwanese adult food intake by food groups and recommended daily intake.

Justification

Nutrition risk has become a hot topic in society and aroused people's wide concern. Moreover, DDS was as good as predictive for mortality compared to Overall Dietary Index-revised and that questions are simple and easy to answer (Lee, Huang, Su, Lee, &Wahlqvist, 2011). Furthermore, no studies to examine that association between how to carry out dietary diversity for older adults this population as well as conducted the framework of TPB model to predict this behavior. Therefore, this study attempts to understand the dietary diversity status and what of barriers make a difficult or impossible for older Taiwanese adults' people to participate in dietary diversity but also solve the barriers.

CHAPTER 2 LITERATURE REVIEW

2.1. Globally Aging and Nutrition

According the World Population Ageing 2013 report show that most countries of the world in the age of fertility decline during the last decades. For example, in Japan, more than half of the population was older than 45 years in 2010, and its median age is projected to rise to 53 years in 2050. Thus, genesis of age-related diseases among old age, these changes are associated with chronic disease as diabetes, hypertension, cancers, cognitive dysfunction and atherosclerosis leading to heart attacks and strokes (Lutz, Sanderson, & Scherbov, 2008). Cognitive dysfunction as Alzheimer's disease (AD) has emerged as the third most costly medical condition in the US, a burden expected to rise in coming years concurrent with the aging of the population (Brookmeyer, Gray, & Kawas, 1998). Preview studies showed that dietary factors that mediate these events likely affect risk for neurodegeneration. Coronary heart disease and stroke have become the major causes of death and disability among both ageing women and men (WHO, 2002). Therefore, the recommended food score has previously been associated with decreased risk of all-cause and cardiovascular disease mortality in large cohorts of both American and Swedish women (Kant, Schatzkin, Graubard & Schairer, 2000; Michels, & Wolk, 2002) and Swedish men (Kaluza, Håkansson, Brzozowska & Wolk, 2007).

Examination of ten year trends in nutritional health and dietary habits in Taiwan is of vital importance as it will aid in the development of dietary recommendations for the public and the development of appropriate nutrition health policies although health status has multiple contributing factors, nutrition is one of the major determinants of successful aging. Nutrition and Health Survey in Taiwan

(NAHSIT) during 2005~2008 found that the prevalence of overweight and obesity in Taiwan has clearly increased as middle age (45-64 years old) and elderly (up to 65 years old) 39% and 34.3%, respected. Furthermore, obesity rate is to rank the first in Asia. Wu, Pan, Yeh, & Chang (2011) to investigate trends in nutrients and sources of dietary intake for Taiwanese people from the Nutrition and Health Survey in Taiwan (NAHSIT) 1993-1996 to 2005-2008. The results showed that intake of cereals and grains, and dietary fiber has decreased, whereas intake of carbohydrate rich convenience foods has increased. Recommend strengthening public nutrition education and changing diet related environment to improve dietary quality and food group distributions. In study by Rivlin (2007) the accumulated evidence strongly suggests that being obese as an older adult greatly increases the risk of serious morbidity and mortality and that intentional weight loss by obese persons reduces the risk of morbidity and mortality. Based on previous study, dietary change and healthy diet is necessary on older Taiwanese adults.

2.2. Importance of Dietary Diversity for Aging

The older Taiwanese adult population is rapid increasing over the past years, when global ageing is a trend in the 21st century because aging issues are becoming increasingly important now a day. Elderly people are at a greater risk of nutritional deficiencies due to physiological changes associated with aging, acute and chronic diseases (Rivlin, 2007). This related to public health issue on elderly, as increased risk of developing a number of age-related diseases, which with increased age. Change of food consumption behavior is necessary (Aberg, 2006). In additional, plenty of studies indicated that dietary diversity has been found to be inversely associated with age adjusted mortality food intake, and to avoid a reliance on a limited number of

food sources that might deplete or disappear in variable environments (Addessi, 2008). Hence, for the above mentioned of all benefits that people should be consumption of a varied diet and then this may help to improve nutritional status and to preserve body mass for elderly population (Bernstein et al., 2002; Marshall, Stumbo, Warren, & Xie, 2001). On the other hand, many studies shown color in a meal affects consumption behavior which people the first sensory is through the eyes and visual appeal like color display with food attractive children (Jansen, Mulkens, and Jansen, 2010) or elderly adult willingness to try and encourage consumption the food (Piqueras-Fiszman, & Spence, 2014) similar increasing the appetite or food acceptable. Thus it can be seen, the benefits of dietary diversity can avoid poor appetite and these benefits were important to older adult.

2.3. Dietary Diversity Score (DDS)

Dietary diversity is defined as the number of individual food groups or food items which are consumed over a specific period (Ruel, 2003). DDS considers both food group numbers and servings and, as developed by Kant, can be a practical and simple tool for these purposes in individuals (Kant et al., 1993). According to the Taiwanese Food Guides Dietary the DDS was presence of 6 food groups (Dalais et al., 1998) as grain, fruit, vegetable, legumes / fish / eggs /meat, dairy, and oil/fat. In additional, diverse diets have been shown related to a decrease in the consumption of unhealthy foods (Elmadfa, & Freisling, 2005) and a lower risk of heart diseases and diabetics. On the other hand, generally recognized as a key component of healthy diets (Rivlin, 2007) related dietary quality and a useful means of measuring food security (Ruel, 2003). Besides, more studies indicate that consumption of a varied diet reduces the risk of developing a deficiency or excess of any one nutrient and

prevention of cardiovascular risk, dyslipidemia (McCullough et al., 2002), somehow be correlating to the dietary nutrient quality. In additional, may risk diversification avoid food security crisis based on dietary diversity become omnivores as well as balanced diet (Burgess and Glasauer, 2004).

Similarly, Labadarios, Steyn, & Nel (2011) found that poor appetite was associated with a higher risk of mortality in a representative free-living Taiwanese older adult population and that this association could be modulated by dietary diversity. In turn, dietary diversity could improve poor appetite which higher DDS and had a good appetited (Lee, Huang, Su, Lee, &Wahlqvist, 2011). In recent year, many studies show that lower DDS associated with factor of household. Nutrition policy directed to food insecure groups, like the aged, could employ health promotion strategies which reduce financial barriers to healthy eating in older adults (Lo, Chang, Lee, & Wahlqvist, 2012) same with low income has been associated with low Fruit and vegetable consumption (Bihan et al., 2010). WHO, 2002 indicated that undernutrition is a global problem that is usually caused by a lack of food or a limited range of foods that provide inadequate amounts of specific nutrients.

2.4. The theory of planned behavior (TPB)

Attitude refers to the degree to which an individual has a positive or negative evaluation of a specific behavior (Ajzen, 1991). Attitude is influenced by behavioral beliefs, which are the subjective probability that the behavior will produce a given outcome. Behavioral beliefs is also associate a behavior with certain outcomes and other attributes, and they determine the attitude toward the behavior in line with the subjective values of these outcomes and attributes (Ajzen, 2002). In additional, beliefs strength and outcome evaluations. Some studies were found that direct effect intention

to consume unhealthy food was predicted by attitude as fast food (Sharifirad, 2013). In addition, stronger intentions were related to more positive attitudes towards eating a healthy diet (Povey, 2000) important attitude including concepts of benefits for health, need for convenience, and desire for good-tasting when to increase fruit and vegetable intake on older adults (Sjoberg, Kim & Reicks, 2004). Hence, the hypothesis for this study is:

Hypothesis1: Attitudes on dietary diversity significant influence on behavior.

Subjective norm is influenced by Normative beliefs are concerned with the likelihood that important referent individuals or groups approve or disapprove of performing a given behavior. Normative beliefs about the expectations of important others strength and motivation to comply with these expectations (Ajzen, 2002). Normative Beliefs give rise to Subjective norm represents the social pressure perceived by an individual to perform or not to perform a behavior (Ajzen, 1991). There is some research that suggests that norms are important for the healthy eating behavior with engagement in healthy eating being influenced by family members, and less by friends and other social situations (Croll, Neumark-Sztainer & Story, 2001). Wansink (2003) found that within a family, food choices may also depend on the needs and taste preferences of other family members, especially nutritional gatekeepers who govern food purchase and preparation. Hence, the hypothesis for this study is:

Hypothesis2: Subjective Norms on dietary diversity significant influence on behavior.

Control beliefs give rise to perceived behavioral control as well as factors that make a behavior easy or difficult, strength and perceived power of these factors to facilitate or inhibit performance of the behavior (Ajzen, 2002). Perceived behavioral control reflects the degree of ease or difficulty that an individual associates with performing a behavior and is assumed to reflect personal experiences as well as anticipated obstacles and resources (Ajzen, 1991). Perceived behavioral control followed by attitudes were the most important factors in predicting behavioral intention. In study by Lo, Chang, Lee, & Wahlqvist (2012), it was found that elders tended to choose foods which would have cost less when lower socioeconomic status. However, a sub-group of elders who achieve the highest DDS with limited money offer approaches to food-money management. In additional, Blue (2007) results showed that subjective norm and perceived behavioral control association with intention to be physically active, and attitude, subjective norm and also perceived behavioral control were related to intention to eat a healthy diet. Moreover, some studies indicated that perceived behavioral control is also assumed to have a direct link to behavior (Ajzen, 1985; Ajzen, 1988). Some study showed that both intention and perceived behavioral control were positively associated with the behavior while reduced-fat milk consumption (Kassem & Lee, 2005). Hence, the hypothesis for this study is:

Hypothesis3: Perceived Behavioral Control on dietary diversity significant influence on behavior.

2.4.1. Without Intention

Intention is in turn determined by behavioral, normative, or control beliefs may succeed in producing corresponding changes in attitudes, subjective norms, and

perceptions of behavioral control and these changes may further influence intentions in the desired direction (Ajzen, 1985). The central construct of the TPB is the person's intention to engage in a particular behavior (Ajzen, 1991) and represents one of motivation in a conscious plan or decision and tends to be a strong predictor of behavior. However, several studies have shown that attitude, subjective norm and perceived control behavior also can direct predict behavior no necessary through intention. Dietary behaviors are often thought of as habitual, which could certainly weaken the intention—behavior relationship (Aarts, Paulussen, & Schaalma, 1997). Similar findings have been reported before in a prospective study on adult fruit consumption (De Bruijn et al., 2007), indicating that reduced the impact by intention—behavior when fruit consumption habits strength. Therefore, intentions not necessarily lead to noticeable behavioral changes (De Bruijn et al., 2007, 2008, 2009; Gardner, 2009; Kremers & Brug, 2008). Hence, the TPB model of this study including attitude, subjective norms and perceived behavioral control direct predict Behavior without intention.

2.5 Application of the theory of planned behavior and dietary diversity

In recent years, carry out TPB into nutrition and used in different ages to explanation attitude, subjective norms and perceived behavioral control to facilities increase heathy dietary and the behavior change is need to all population due to do not meet the dietary advice, present in Table 1. Moreover, low consumption rates amongst young adults suggest the need for programs designed specifically for this population. Besides that fruit and vegetable consumption has wide ranging implications, including decreased risk of cancer, heart attack, and stroke (Dauchet, Amouyel, & Dallongeville, 2009; WHO, 2002; He, Nowson, & MacGregor, 2006).

Perceived behavioral control was the strongest predictor of intentions and behavior. Nevertheless, not necessarily through intention predicting behavior if perceived behavioral control was stronger.

Nutrition balance and diet diversity will become more relevant dimensions of healthy diets in China, compared with calorie and nutrition adequacy. Thus, a view supported by Lo et al., (2013) that is generally thought that a varied diet being nutritional improvements, present in Table 2.

Table 1: Using the theory of planned behavior in nutrition

Reference	Age	Intervention	Methodology	Finding/Conclusion
Andrews, Silk, & Eneli, (2010)	Pre-school/Child		**Sample:** Mothers with young children between the ages of 2–5 (*n* = 201). **Measurements:** Questionnaire or an online survey. **Statistical analysis:** Construct Validity and descriptive statistics.	Important for health campaigns to target parents' attitudes toward healthy eating and the necessity of providing healthy foods for their children. Limiting TV viewing would keep their children healthy.
Lautenschlager, & Smith, (2007)	Pre-school/Child	pre- (*n* =96); post-survey (*n* =66)	**Sample:** Boys (*n* =42) and girls (*n* =54), aged 8–15 years. **Measurements:** Questions and a 24-h recall. **Statistical analysis:** Descriptive statistics, Mann–Whitney U analyses, correlations and regression analyses.	PBC was identified as most predictive of behavior change in girls, with no constructs associated to post-survey behavior in boys.

Blanchard et al., (2009)	Adolescent/Adult	5-A-Day	**Sample:** 511 college students with a mean age of 19.8 years **Measurements:** 5-A-Day questionnaire. **Statistical analysis:** Path analyses and invariance, descriptive and correlations, ANOVAs and regressions.	Strategies to increase the students' sense of control to engage in this behavior as a central component when increasing intentions to eat 5 fruits and vegetables per day.
De Bruijn, (2010)		Adolescent/Adult	**Sample:** (*n* = 538; mean age = 21.19). **Measurements:** Focus group interview **Statistical analysis:** Regression analysis, simple slope analysis, and discriminant function analysis.	Findings suggest that stronger fruit consumption habits make fruit consumption less intentional and that interventions aiming to increase fruit consumption may need to develop persuasive messages focusing on situational beliefs, rather than emphasizing health outcomes.

Kothe, Mullan, & Butow, (2012)	Adolescent/Adult	Email messages designed to increase fruit and vegetable consumption.	**Sample:** 18 to 25y (*n* =194). **Measurements:** Questionnaire with 7-day diary and biomarkers. **Statistical analysis:** Descriptive, correlations, regressions, interaction analysis and discriminant analysis.	Fruit consumption does not only have an intentional component, but also has a habitual and automatic component.
Nigg, Lippke, S., & Maddock, J. E. (2009)	Adolescent/Adult		**Sample:** Gender (*n* =3533), age 19–34/35–54/55+ **Measurements:** Theory of Planned Behavior-based questionnaire **Statistical analysis:** Descriptive statistics, regression analysis, Structural equation modeling (SEM).	The major finding is that there were only a few differences that were statistically significant when testing the interrelationships of the social cognitive variables with intention and behavior across groups.

Liu, P., & Kwon, J. (2013)	Elderly	**Sample:** 115 over 80% were 75 years or older. **Measurements:** Questionnaire **Statistical analysis:** Descriptive Statistics, r regression	The results of this study confirmed that elderly population living in elder care facilities desires and are willing to choose healthy food choices but feel the lack of their control over food choices.

Table 2: Characteristics of the studies that looked at the dietary diversity

References	Age	Methodology	Finding/Conclusion
Kennedy, Pedro, Seghieri, Nantel, & Brouwer, (2007)	Pre-school/Child	**Sample:** 24–71 month of age in the Philippines 1993 National Nutrition Survey (*n* = 3164 children and 4050 households). **Measurements:** 24-h recall.. **Statistical analysis:** Pearson's Correlation, linear regression, Sensitivity and specificity analysis.	DDS and DDS 10g were both significant predictors of adequate micronutrient intake. This study demonstrates the utility of indicators of dietary diversity to predict adequate intake of micronutrients in the diets of young non-breast-feeding children.
Steyn, Nel, Labadarios, Maunder, & Kruger, (2014)	Pre-school/Child	**Sample:** Ages 1 to 9 y (*n* = 2200). **Measurements: DDS**-24-h recall, four food group indicators (G6, G9, G13, G21), mean adequacy ratio (MAR) and Nutrient adequacy ratio (NAR). **Statistical analysis:** T-test and Bonferroni post hoc test, Pearson's correlations, Sensitivity and specificity.	Overall results seem to indicate that any of the four G indicators can be used in dietary assessment studies on children, with G13 and G21 being marginally better. More energy from carbohydrates and less from protein and fats than urban children.

Arimond el at., (2010)	Adolescent/Adult	**Sample:** 100 of women and age (15–49 y) . **Measurements:** Food and Nutrition Technical Assistance Project initiated the Women's Dietary Diversity Project (WDDP), 24-h recalls, food group diversity indicators (FGI) and mean probability of adequacy (MPA). **Statistical analysis:** 1-way ANOVA, Bonferroni's correction, Pearson correlations and simple linear regressions, receiver-operating characteristic analysis.	Results suggest that relationships between food group diversity and micronutrient adequacy may vary by season
Azadbakht,Haghighatdoost, Feizi, & Esmaillzadeh, (2013)	Adolescent/Adult	**Sample:** Women of 18 to 28 y old (*n* =411) . **Measurements:** Semi quantitative food frequency questionnaire (FFQ). **Statistical analysis:** Mean, Wilks λstatistic. chi-square test, described variables and linear-by-linear association.	Breakfast consumers had a lower daily energy intake, a less dietary energy density, a lower BMI, and a smaller WC compared with breakfast skippers and higher scores of dietary HEI and dietary diversity for fruits, vegetables, and whole grains lower intake of cholesterol.

Oldewage-Theron, W., & Kruger, R. (2011)	Adolescent/Adult	**Sample:** A randomly selected sample of black women (*n* = 426). **Measurements:** pretested socio-demographic questionnaire and validated questionnaires (1-wk quantified food frequency questionnaire: diversity measures; 24-h recall: nutrient intake; Cornell Hunger Scale: coping strategies). Food variety scores and 9 food groups' diversity scores, nutrient adequacy ratios and mean adequacy ratio. **Statistical analysis:** Descriptive statistics SPSS-Pearson's correlations, Sensitivity and specificity.	Limited food access and food variety in poor households resulted in inadequate nutrient intakes (low nutrient adequacy ratios), confirmed by poor dietary diversity (food variety score and food group diversity score).
Sodjinou, Agueh, Fayomi, & Delisle, (2007)	Adolescent/Adult	**Sample:** 200 of men and women aged 25–60 years. **Measurements:** 24-h recalls. Micronutrient adequacy score (MAS) and healthfulness score (HS). Socio-demographics were documented using a questionnaire. **Statistical analysis:** Cluster analysis, t-test or Mann–Whitney test, Backward linear regression.	Programmers focusing on the prevention of diet-related chronic diseases in this population should encourage the maintenance of the healthful elements of the diets, while emphasizing consumption of fruits and vegetables.

Conklin et al., (2014)	Elderly	**Sample:** All the respondents were black (*n* = 169), aged between 60 and 110 years with a mean age of 71.2 years. **Measurements:** Health food frequency questionnaire, 24 h-recall questionnaires, and anthropometric and biochemical measurements. **Statistical analysis:** Levene's test, foodfinder1 version 3 program, frequencies.	The results showed that food variety and dietary diversity scores give a fairly good assessment of the adequacy of the diet, and scoring dietary diversity is a significant, yet simple tool to identify elderly persons at risk of food and nutrition insecurity.
Oldewage-Theron, & Kruger, (2008)	Elderly	**Sample:** 9580 adults (50–79 years). **Measurements:** Health and Life Experiences Questionnaire (1996–2000) and Food Frequency Questionnaire (1998–2002). **Statistical analysis:** Descriptive statistics, Regression and Sensitivity.	Greater economic disadvantage consistently consumed fewer different fruits or vegetables, but not lower amounts. Importance of variety and focus on improving fruits variety in women and vegetables variety in men among older adults.

CHAPTER 3 METHODOLOGY

3.1 Research Design

Based on the past study about TPB model indicated that predict behavior do not necessarily through intention also achieve the research objectives. This study proposes the research framework as depicted in Figure 2. The hypotheses for this study are:

Hypothesis1: Attitudes on dietary diversity significant influence on behavior.

Hypothesis2: Subjective Norms on dietary diversity significant influence on behavior.

Hypothesis3: Perceived Behavioral Control on dietary diversity significant influence on behavior.

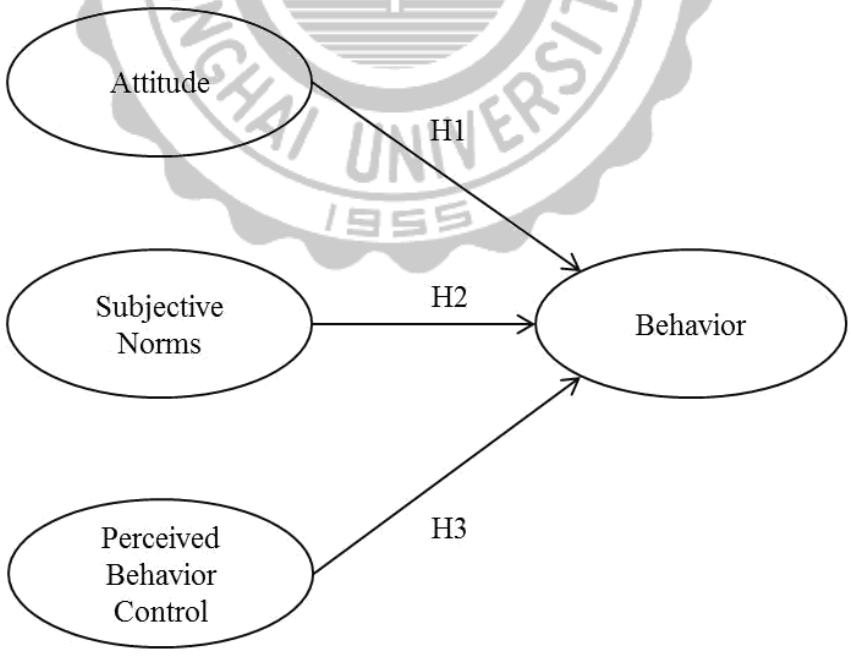

Figure 2: Modify from the theory of planned behavior (TPB)

3.1.1 Sample

In recent year, the survey sample of Report of the Senior Citizen Condition Survey, 2013 was including aged 55 years and above. In additional, the findings in "Nielsen Aging Report, 2014", according to governmental data of Taiwan, the population of baby boomers (50-65 years old) still represents 22% in total. Also, this population is accustomed to eating foods from a diverse cultures, is health conscious, represents the majority of the workforce, willing to spends more on food compared to other generations, and has the most disposable income (Dornblaser, 2010; Worsley, Wang, & Hunter, 2010). For this study, the subjects who aged above 55 years living in Centre Taiwan were sampling and determined of 300 surveys will be expected.

On the other hand, through learning center and senior activity institutions to ascertain who willingness to participate. Once they consent, a visit was schedule for data collection, and there would be some people that cold assist with distributing the questionnaire or assist older Taiwanese adults that needs help understanding the questionnaire.

3.2. Measurement

3.2.1. Questionnaire Design

A self-administered questionnaire development was based on the input of an extensive review on the topic of theories and research regarding the situation of dietary diversity on older Taiwanese adults and dietary diversity (a) Dietary Diversity Score (DDS) explanation with poster; (b) factors of attitude, subjective norms and perceived behavioral control toward behavior; (c) demographic information were

included in the initial questionnaire to determine the participants' age, gender, education and marriage status and more.

Dietary Diversity Score (DDS) was based on the presence of 6 food groups (Dalais et al., 1998) as grain, fruit, vegetable, legumes / fish / eggs /meat, dairy, and oil/fat according to the Taiwanese Food Guides. Therefore, Half a serving per day was required for a DDS score of 1 (Lee, Huang, & Wahlqvist, 2010). Hence, the DDS ranged from 0 to 6 with higher scores associated with better nutrient intakes (Kant et al., 1993; Lee et al., 2011). Each item was presented "Yes" or "No".

Attitude was defined as favorable or unfavorable evaluations about the behavior. Each item was presented on a Likert scale for 5-points from 1 (strongly disagree) to 5 (strongly agree) (Ajzen, 1991).

Subjective norm was defined as perceived social pressure to perform behavior. Each item was presented on Likert scale for 5-points from 1 (strongly disagree) to 5 (strongly agree) (Ajzen, 1991).

Perceived behavior control was defined as reflects the degree of ease or difficulty that an individual associates with performing a behavior and is assumed to reflect personal experiences Each item was presented on a Likert scale for 5-point from 1 (strongly disagree) to 5 (strongly agree) (Ajzen, 1991).

3.3. Expert Panel

The expert panel was selected to review the content validity of the questionnaire. The panelist consisted of 5 directors that have knowledge concerning older adult, nutrition and hospitality professional, and two dieticians. Each panel member received and reviewed the questionnaire by answering the listed questions that would help to evaluate if the wording, space and letter size of each items,

suitability of the scale, clarity of instruction, and overall design of questionnaire were clear enough for older adults to answer. And that, part of DDS about the "half a serving per day" through two dieticians suggested that half serving is vegetable of 50g one day (Lee, Huang & Wahlqvist, 2010), draws up the initial questionnaire after modified (APPENDIX B).

The initial instrument was then pretested with a pilot sample (N=65) within the population of interest and refined with respect to clarity, formatting, and constructs validity before distributing the actual survey. Pilot tests of 65 samples were complete surveys received during 10, 14 and 15 April, 2015 in a community center and learning center. Participants were asked to review and complete the questionnaire. The pilot test was able to evaluate the reliability of the questionnaire and to increase the content validity of each question. The Cronbach's α scores were expected to be higher than .70 suggested by Nunnally and Bernstein (1994).

3.4. Data Analysis

The Statistical Package for the Social Science, Windows Version 19.0 (SPSS 19.0) was used to analyze the quantitative data. The types of procedures analyzing this data were descriptive statistical for frequency distribution on socio-demographic characteristics; DDS show mean and standard deviation to understand the participants degree of eating a diverse diet; Cronbach's α for the reliability of each constructs and regression analyses. Constructs validity refer to whether all the items for the variables represent one single construct. Construct validity will be establish by expert panel. Reliability refers to the degree of stability of the scale (Jackson, Chow, and Leitch, 1997). Reliability of the construct demonstrated by checking the Cronbach's alpha (α) for the items for each construct and the correction among the item for the construct.

Typically, a scale said to be reliable if alpha is .70 or higher (Nunnally & Bernstein, 1994). Finally, linear regression analysis was used to determine which three variables of TPB had influence on the DDS.

3.5. Statistical Analysis

3.5.1. Focus Group

In an attempt to better understand dietary diversity on older Taiwanese adult and test the initial questionnaire, the focus group was conducted by purposive sampling during 27, September and 26, November, 2014 and a total of 33 completed surveys received. This study employed to develop and pilot test the initial questionnaire. Questionnaires were conducted with responses to test the determinant of a eating a diverse diet and attitude, subjective norms, and perceived behavior control related to dietary diversity behavior. The participants were asked to complete (a) the advantages/disadvantages of dietary diversity, (b) the persons who would approve or disapprove of dietary diversity, and (c) factors that would enable/difficult you to participate in dietary diversity, total six questions (Sutton et al., 2003)

To obtain useful information to development part of attitude, subjective norms and PBC (see Table 3). Frequency of Balance diet, healthy and facilitate food intake from the participates responses were showed that 20, 17 and 2, respectively. Similar, disadvantages of dietary diversity were indicate that frequency of time-consuming, uncomfortable and purchase inconvenience were listed by 9, followed by were 7 and 2, respectively. Parts of subjective norms were showed that frequency of family, professionals, TV and friends/community groups 7, 5, 3 and 3, respectively. In additional, frequency of disapprove were showed that family, professionals and

friends/community groups 5, 3 and 1. Finally, part of perceived behavior control according the factors to develop the questionnaire from frequency of dietary habit and healthy were listed by 13 and 12, respectively as well as purchasing inconvenience, physiological factors of aging and time-consuming were showed that 6, 5, and 4, respectively. According these factors to develop of each items of attitude, subjective norms and perceived behavior control. In additional, factors of time-consuming and purchase inconvenience were overlap both on attitude and PBC. Moreover, items of three measurements get were not only get from focus group but also conduct by previous studies showed time-consuming and purchase inconvenience more likely to barrier PBC and put in (Backman, Haddad, Lee, Johnston, P& Hodgkin, 2002), then the SN and PBC and so on.

Finally, complete the initial questionnaire through past literature after checking for expert panel then modify and pilot test. Such as, carry out the TPB model to assess perceived availability of healthy food choices among elderly living in facilities in Kansas and this study found that the SN was most influence of elderly willing choice the healthy food like family members, medical providers and cooks and foodservice staffs were greater than friends (Emanuel, McCully, Gallagher, & Updegraff, 2012).

Table 3: Frequency of Factors by Six Questions

Measurements	Factors	Frequency (N=33)
	The advantages of dietary diversity	
	Balance diet	20
	Healthy	17
Attitude	Facilitate food intake	3
(AT)	**The disadvantages of dietary diversity**	
	Time-consuming	9
	Uncomfortable	7
	Purchase inconvenience	2
	Approve of dietary diversity are influence by individuals or groups	
	Family	7
	Professionals	5
Subjective	TV	3
Norms	Friends/Community groups	3
(SN)	**Disapprove of dietary diversity are influence by individuals or groups**	
	Family	5
	Professionals	3
	Friends/Community groups	1
	Enables to participate in dietary diversity	
	Healthy	13
Perceived	Dietary habit	12
Behavior	**Difficult or impossible to participate in**	
Control	**dietary diversity**	
(PBC)	Purchase inconvenience	6
	Physiological factors of aging	5
	Time-consuming	4

3.5.2. Pilot test

A total participate of 65 completed survey received and the Cronbach's alpha (α) for each construct is shown in Table 4. Attitude and subject norms were included five items (Cronbach's α = .777 and .725, respectively) achieved Cronbach's α scores great than .70 suggested by Nunnally and Bernstein (1994). Except perceived behavior control was found to be less than .5 of Cronbach's α scores. Hence, this study eliminated PBC 1, the item was asked ("impossible to participate in dietary diversity due to time-consuming when prepare a variety of ingredients, also wash and cooking"). After the item eliminated, Cronbach's α score =.131 up to α=.674.

Table 4: Reliability of Measurement by eliminated

Construct	Number of items	Cronbach's alpha(α)
Attitude	5	.777
Subjective norms	5	.725
Perceived behavior control	5	.674

3.6. Data Collection

To acquire the primary data, researcher contacted the unit directors to explain the purpose of the study and approval was received from group leader of each site, and detailed information about further arrangements was determined after issuing questionnaires with permission. Table 5 shows all data collection sites 7 sites under the Hondao Senior Citizen's Welfare Foundation organizing, 3 activity institutions and 6 senior schools. The number of overall issued questionnaires is 471, including 406 usable samples yielded from 16 data collection sites were response rate is 86.2%. Data included in the analysis meet the following criteria: 1) the age of participates (above 55 years), 2) Dietary Diversity Score, and 3) each survey with less than half missing answers. Survey was excluded if responses didn't match any of the criteria

mentioned above. The survey is done in May for two months, 2015 in Central Taiwan.

Table 5: Data Collection Sites

Date	Time	Sites	Issued question-naires	Valid questionnaire
4/10-4/29	9:10-11:20	7 sites of Hondao Senior Citizen's Welfare Foundation	166	124
4/24-5/15	9:10-11:20	3 of activity institutions	23	23
4/27-5/27	9:20-16:20	6 of senior school	282	259
Total		**16**	**471**	**406**

CHAPTER 4 FINDING & DISCUSSION

The statistical analyzed this chapter including descriptive statistics and assessing the reliability of the measures used in this research. Finally, followed by testing for regression model and hypotheses.

4.1. Descriptive Statistics

4.1.1 Descriptive Analysis

A total of 471 valid questionnaires were collection. Sixty-five questionnaires were eliminated from the analysis because the respondents were not complete questionnaires and marked for same rating as "no opinion" on consecutive questions.

All of 406 usable questionnaires were obtained. Demographic characteristics are shown in Table 6. In which total of 406 usable samples, more than half (74%) of the female and 26% of the male. The majority of the study populations were aged younger than 75 years between 65 and 74 years old (43%) and mean age is 77 years old. Sixty- seven percent of the older Taiwanese adult was married and 28% were windowed. Most of participants of education also ended with high school (27%), followed by elementary school (26%) and bachelor's degree or high (24%), lower percent of middle school, illiterate were listed by 18% and 6%, respectively . On the other hand, 61% of the older adults living with family member then living with spouse (26%) and living alone (12%). Approximately, over half of respondents in which food prepare by myself (61%), 34% of prepare by family member and a few (5%) food away for three meals a day.

Table 6: Respondents Demographic Characteristics

Characteristic	Variables	Frequency	Percent (%)
Gender (N=406)	Male	104	25.6
	Female	302	74.4
Age (y) (N=406)	55-64	104	25.6
	65-74	174	42.9
	75-95	128	31.5
Marital status (N=406)	Married	270	66.5
	Widowed	115	28.3
	Cohabitation	4	1.0
	Divorced	11	2.7
	Single	6	1.5
Education (N=406)	Illiterate	24	5.9
	Elementary	105	25.9
	Middle school	71	17.5
	High school	108	26.6
	Bachelor's degree or high	98	24.1
Residence (N=406)	Living with spouse	107	26.4
	Living alone	48	11.8
	Living with family members	249	61.3
Food preparation (N=406)	Prepare by family members	137	33.7
	Prepare by myself	248	61.1
	Food away	21	5.2
Dietary Diversity Score, (range:0-6) (N=406)	≦3	6	1.5
	4	31	7.6
	5	170	41.9
	6	199	49.0

Table 6 was showed that DDS shown that the scores range by 0-6 and frequency of participant ate the testing day before for each food group. Thus it can be seen that 199 of respondents and roughly half (49%) in survey were achieved DDS= 6 and one of four (41.9%) participants were reported that ate for 5 food group as DDS=5; DDS=4 was reported by 31 participant; 6 of lower DDS $\leqq 3$ and overall (mean±SD= 5.37±.745) indicated older adult was higher intake for each food groups. Food intake frequency of the major food groups were present in Table 7 that six food group and including "grain" (N=406), following by "vegetable" (N=397), "legumes / fish / eggs /meat" (N=387), "oil/fat" (N=385) and "fruit" (N=384) were highly intake by these four group they ate more than 90%. Whereas, only the "dairy" (N=222) was showed difference with other 5 food group half of participant lower intake. Hence, it is certainly something to be aware of and after through discussion for improve this situation.

Table 7: Food Intake Frequency of The Major Food Group

Food group	Frequency (N=406)	Percent (%)	Total DDS Mean±SD (DDS range:0-6)
Grain	406	100	5.37±.745
Vegetable	397	97.8	
Legumes / fish / eggs /meat	387	95.3	
Oil/fat	385	94.8	
Dairy	222	54.7	
Fruit	384	94.6	

4.1.2 Result of Reliability for Three Measurements

Internal consistency or reliability of each resulting factors was assessed using Cronbach's alpha (α) with acceptable reliability estimate set at .70 (Nunall, 1978), and the correlation among the items for the construct. The alpha coefficients' for the three factors as attitude (.795), subjective norms (.764) and PBC (.804) were higher reliability in this study. The result of reliability was shown on Table 8.

4.1.3 Descriptive Analysis of Three Measurements

Table 8 were showed the mean ± SD that items of degree of each measurement about varied diet on older Taiwanese adult. Part of attitude, the top 3 higher mean were items of AT1 (*"… feel healthy"*) (Mean ± SD= 4.35 ± .602), followed by AT2 (*"…abundant in food"*) (Mean ± SD = 4.26 ± .621) and AT4 (*"… a lot of change of food as colorful and smell attractive me to eat"*) (Mean ± SD = 4.26 ± .842) (see Appendix 1) indicated that the food who feel healthy, various and display rich in color in meal were factor of attractive older adult active to dietary diversity.

The top 3 subjective norms higher mean were item of SN2 (professional) (Mean ± SD = 4.00 ± .790) next on SN5 (community) (Mean ± SD = 3.91 ± .880) and SN1 (family members) (Mean ± SD = 3.81 ± .810) (see Appendix A) showed that professional, community and family members can help people to healthy diet if give the older adult population advice on eat every food groups for 3 meals a day.

Many of the respondent felt that the following the top 3 mean score for the perceived behavioral control scale as barriers toward dietary diversity showed that the factor of PBC3 (*"… bad teeth"*) (Mean ± SD=3.42 ± 1.106), continue by PBC5 (*"…easily to get buying overload"*) (Mean ± SD = 3.31 ± 1.116) and PBC2

(*"…purchases inconvenience"*) (Mean ± SD = 3.05 ± 1.135) (see Appendix A), it is factors of unable to dietary diversity among older Taiwanese adult as bad teeth lead to limited the food selection as well as because of chewing difficult more like eat soft food and they fear buying overload easily waste food owing to few family member to share like only live with spouse and live alone. Moreover, if varied diet need to consider the food group when buy and another of reason by sometime ingredient of buyer is not the cook.

Table 8: Descriptive Analysis of Three Measurements

Factor	Variables	Mean ± SD	Cronbach's alpha (α)
Attitude (N=5)	AT 1	4.35 ± .602	.795
	AT 2	4.26 ± .621	
	AT 3	4.17 ± .659	
	AT 4	4.26 ± .842	
	AT 5	3.96 ±. 608	
Subjective Norm (N=5)	SN 1	3.81 ± .810	.764
	SN 2	4.00 ±.790	
	SN 3	3.50 ±.986	
	SN 4	3.75 ± .824	
	SN 5	3.91 ± .880	
Perceived Behavior Control (N=5)	PBC 2	3.05 ± 1.135	.804 .
	PBC 3	3.42 ± 1.106	
	PBC 4	2.71 ± 1.136	
	PBC 5	3.31 ± 1.116	
	PBC 6	2.97 ± 1.147	

Note. AT= attitude; SN= subjective norms; PBC= perceived behavior control

4.2 Regression Analysis

4.2.1 Correlations between Measurements

Table 9 includes the Pearson correlation coefficients were examined to explore the relationships among each measurements. The SN was positive significantly correlated with AT (r = .356, p < 0.01) and PBC (r = -.135, p < 0.01); PBC only significantly correlated with SN was negative. DDS was all positive significantly correlated with AT (r = .166, p < 0.01) and SN (r =.208, p < 0.01) but not including the PBC. Subsequently, three measurements were included in the regression analysis.

Table 9: Correlations between Measurements

	AT	SN	PBC	DDS
AT	1			
SN	.356**	1		
	.000			
PBC	.038	-.135**	1	
	.450	.007		
DDS	.166**	.208**	.075	1
	.001	.000	.131	

Note. AT= attitude; SN= subjective norms; PBC= perceived behavior control;
DDS= dietary diversity score.

**p< 0.01(two-tailed), significantly correlation.

4.2.2 Linear Regression

In the linear regression, the model explained significant portion of total variance; F-value confirmed overall significance of the models at the $p < 0.001$. Every VIF-value smaller than 10 suggested there's no substantial multicollinearity problem in examination (Afifi, 1990). The result of this study was shown that the main an analysis for DDS affected by subjective norms and perceived behavior control excluded attitude among older Taiwanese adults.

Using the regression revealed that all these predictor variables explained amounts of unique variance in DDS indicated that overall three measurements of explanation by 6.2% ($F = 8.865$, $p < 0.001$***, Adj. $R^2 = .055$) and highest VIF value obtained was 1.174 less than 10, indicating that multicollinearity was not a problem (see Table 10). SN ($\beta = .187$, $t = 3.572$, $p < 0.001$***) and PBC ($\beta = .097$, $t = 1.975$, $p < 0.49$*) were slightly positive significant determined of DDS while AT ($\beta = .096$, $t = 1.846$, $p > 0.05$, *n.s*) was no significant effect on dietary diversity. Thus, probably SN and PBC were weakened AT. Hence, the result of this study was indicated that SN was more important in explaining variance in DDS compared to PBC however affect by AT was no significant (see Figure 3).

Table 10: The Result of Linear Regression Analysis for DDS

Variables	Standardized Coefficients	t	Sig.	F value (p value)	*VIF*
	β				
AT	.096	1.846	.066	8.865	1.155
SN	.187	3.572	.000***	.000	1.174
PBC	.097	1.975	.049*		1.027

Note. AT= attitude; SN= subjective norms; PBC= perceived behavior control.

Overall of R^2= .062, *Overall of* Adj. R^2= .055, F= 8.865; ***p < 0.001, **p<0.01, *p<0.05.

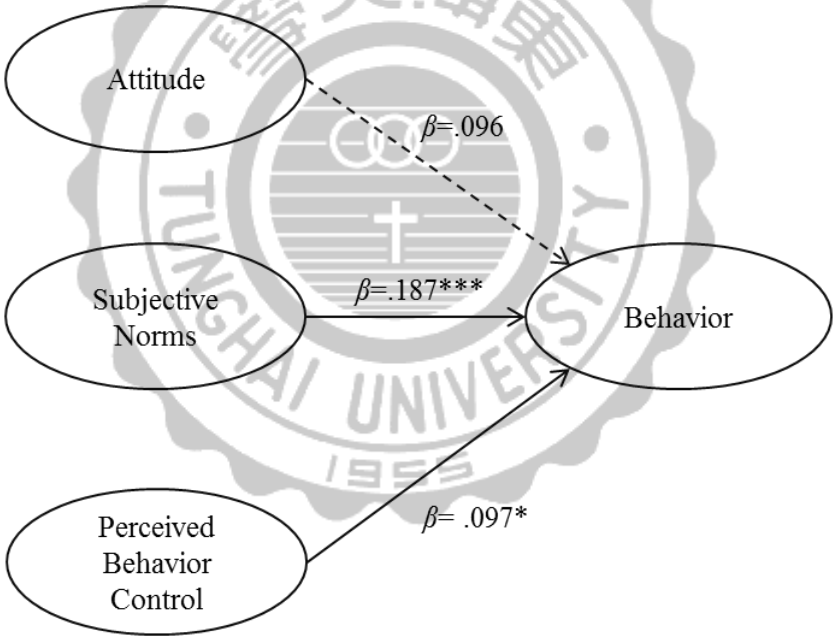

Figure 3: Regression for the theory of planned behavior (TPB)

4.3 DISCUSSION

The purpose of this study was to demonstrate the factors influence on dietary diversity behavior aged up to 55 years and living in the Central Taiwan. In this section, the clarify and discussion of all findings are presented following each hypothesis of this study. The results of this study was found that the majority of respondents' age range for 65-74 years old and most are women, living with family member as well as food prepare by myself for often meals daily achieve higher DDS almost range by 4-6 (Huang et al., 2014; Lee et al., 2010; Lo et al., 2012)indicted that older Taiwanese adult eat a more varied diet who cook the food myself than eating out and without living alone were increase their consumption for each food group (Sjoberg, Kim, & Reicks, 2004).

4.3.1 Intake of dietary diversity

The physiologic processes of decreased physical activity and the altered regulation of food intake leading to a decrease in food intake with poor appetite in older persons (Morley, 1997). DDS is key element association with dietary quality which simple DDS was high similarly good dietary quality (Xiu et al., 2012) and greater than Overall Dietary Index-revised (ODI-R) than predict the mortality (Lee et al., 2011; Lo et al., 2012) it is known from this result about the appetite of older Taiwanese adult (Donini et al., 2013; Huang et al., 2014). The finding in this study indicate that obtained most of older Taiwanese adult was higher DDS and high intake for each food groups except dairy product present by Table 5,6 . The findings fit with some studies supporting five food groups as grain, fruit, vegetable, legumes / fish /

eggs /meat and oil/fat for higher intake among older Taiwanese adult were observed and especially grain is all older adult have eat because it is common staple food as rice for consumption rate is almost 100% in Taiwan (Lo et al., 2012). Besides that, around half of respondent lower intake of dairy products but it is important for everyone particular older adult cause dairy products are rich sources of calcium and other important nutrients (Joe Millward, & Garnett, 2010). Because of this, Chinese food seldom use the dairy products in the daily meal compared with Western food and demand of dairy product is larger than Chinese food due to recommendations 3 cups per day of fat-free or low-fat milk and milk products for elderly in United States (Dietary Guidelines for Americans, 2010)and Switzerland recommends 3-4 servings per day (Chollet et al., 2014) whereas 1.5 cups per day in older Taiwanese adult (Food and Drug Administration, 2012) as well as milk has not been widely available in Taiwan until the recent decades (Tsai, Liou, & Chang, 2006). Support by previous findings that older Taiwanese adult high as 47% of men and 38% of women consume milk less than once per week (Tsai, Liou, & Chang, 2006) and Switzerland of older adults (50 to 81years) reported 2.6 portion consumption of dairy products less than 3-4 portions recommended per day (Chollet et al., 2014). Otherwise, this is another reason of lactose-intolerant high prevalence in the elderly (Casellas, Aparici, Casaus, & Rodríguez, 2013) similar common in older Taiwanese adult this population (Tsai, Liou, & Chang, 2006), it is lead to reduce consumption of dairy product. Therefore, findings of this study indicated that poor dairy intake must modify and remain higher DDS to better the older Taiwanese adult.

4.3.2 Attitude, Subjective Norms, PBC towards Behavior

Most of studies carry out the attitude, subjective norms and PBC towards intention but little direct link to behavior. Nevertheless, this study using the TPB to predict dietary diversity without intention among older Taiwanese adult. The result of this study indicated that subjective norms and PBC was stronger predictor for behavior, except the attitude. The findings support and extend two previous studies for attitudes was not effect on behavior that some possible reasons of the results in this study effect is probably a statistical artifact because PBC was not significantly association with attitude and DDS in the simple correlations accurate predictions the behavior (Conner, Norman, & Bell, 2002). It follows that, attitude-actual behavior inconsistency prove by Fishbein, & Ajzen (2011), for a review that attitudes formed based on direct experience for behavior are more valid predictors of future behavior.

Besides that, PBC not only raised attitudes was no direct link to behavior but also significant influence on DDS among older adult. For instance, while older adult have a positive attitude towards dietary diversity they will engaged in this behavior. Whereas, if aware of the difficulties is hard to solve may give rise to attitude change for older adult than young people. Because young people try to solve these barriers easier than older adult due to physiological factors of chewing difficult because of their old teeth, waste of ingredient if living with few family members easily trend to buying overload. Based on these inconvenience factors strongly affected older adult still unable to dietary diversity even they know it is good for them to maintain their healthy. This study partly supported in studies by participants who have better chewing ability as good as dietary quality according to their DDS. The result showed that over half of older Taiwanese adult higher risk of mortality if chewing difficult than those who had satisfactory chewing ability and limited their food choice (Lee et

al., 2010). In additional, study by Olsen, Scholderer, Brunsø, & Verbeke (2007) indicated that people who perceived inconvenience of food has a negative direct and indirect effect on food consumption through attitudes. It can be seen, inconvenient have significantly lower attitudes and reduce the food intake. Similar, the result also account for attitude no significant effect on DDS in this study. Perceived behavioral control was most important in explaining both intention and actual intake of vegetables among older adult (Sjoberg, Kim, & Reicks, 2004), followed by attitudes and subjective norms.Therefore, the hypothesis1 and proposed in this study had been proved, the result reject attitudes whereas PBC on dietary diversity significant influence on behavior that hypothesis 3 was supported.

For subjective norms toward DDS results showed that influence of professional, community, family members and friends were greater than media. In additional, older adult before perform a behaviors that more likely to evaluate the opinion of important others (Emanuel, McCully, Gallagher, & Updegraff, 2012; Liu & Kwon, 2013) was consistent with this finding showed older Taiwanese adults who engage in dietary diversity behavior that most important encouraged by professional, community and family members to eating a variety in foods was demonstrate by SN strongest effect on dietary diversity than PBC and attitude. Thus, supported by previous studies that subject norm was most influential compared with attitude and PBC, have research showed subjective norms more than attitudes or perceived behavioral control for predicted intentions to drink (Huchting, Lac, & LaBrie, 2008; Kelly, Deane, & Lovett, 2012) and behaviors (Perkins, et al, 2007). On the other hand, the finding of Liu & Kwon (2013) showed that the older adult population living in health care facilities desires and are willing to choose healthy food choices. It can be seen, community can influence them to healthy diet, and it is perhaps have somebody

to handle instantly when they face on difficult. If higher level of social support were related to increase their intake of fruit and fiber as well as decreased conscious effort in consuming less fat and reduction red meat to better dietary behavior (McIntosh, Sykes & Kubena, 2002; Hye-Cheon Kim, Alex Mcintosh, Kubena, & Sobal, 2008.). Hence, subjective norms on dietary diversity significant influence on behavior as illustrated in Table 10, hypothesis 2 was supported.

CHAPTER 5 IMPLICATION & CONCLUSIONS

5.1 Contribution

The results will provide important insights in to more diverse diet and information to Health Care Facilities management for older Taiwanese adults' lack of nutritional requirement. Contribution for TPB model was combination with simple DDS which no one has ever done before and this study without intention was direct predict dietary diversity behavior inconsistent with previous studies applied the TPB predict intention and behavior (through intention was indirect). Therefore, the result of this study can direct to understand actual behavior rather than through intention and many studies was indicated that gap of intention towards behavior. Besides that, not only add new issues about DDS into field of the TPB but also confirm the subjective norms and PBC were direct positive significant influence on behavior and attitude did not without intention.

5.1.1 Suggestion to Government

These findings may provide government the necessary information for making recommendations to improve the dietary pattern of the older Taiwanese adult.

1. To Create a Positive Image for the Dairy products

   In recent years, plenty of dairy products related events such as the came out melamine tainted milk powder event in the China in 2008; in 2012, the United States mad cow disease was discovered; in 2013, Dicyandiamide tainted milk was found out in New Zealand is shocked the world . It's seriously damaged the image of dairy products thus along with

   the people living standard enhancing and the consciousness of food security

strengthening, there are more pay attention request the high quality of food. For instance, older adult respondents reported that safe and health have to take into consideration when they intake of dairy products (Chollet et al., 2014). Every product is strictly examined before it is put on the market. Aimed at Lactose intolerance should information about dairy products as low-lactose and lactose-free are available might improvement lack of consumer dairy products for older adult.

2. Diet Education and Practical

From the results indicate that the most influence older Taiwanese adult to diversity diet is professional，followed by community and family. Degree of medical use is extremely high on older Taiwanese adult. It can be seen, the professional as doctor and dietician was admitted into their fullest confidence. Professional have promoted the dietary diversity should give proper guidance in this matter for older adult at senior school. For example, learning center need more invite the professional to speech about the dietary diversity that they are more aware of the advantages with true on diversification of diet; in the light of majority of older Taiwanese adult was prepare the meal themselves and have study showed that the cook who making food preparation easily to healthy eating (Zanjani, Schaie & Willis, 2003; Chenhall, 2010). So must teach them how to do dietary diversity use in 3 meal a day through cooking classes in order to it can perform the in real life when cook because of result that if higher DDS association with cook skill and highly frequent cooking activity predicts survival among elderly Taiwanese (Chen, Lee, Chang, & Wahlqvist, 2012).

3. Convenience of food

Furthermore, the 21st century is an information century in which information has been an important resource for every walk of the society. Increases the opportunity of connect with high-tech products like computer and iPad for older adult particular baby boomer this population , believe that online shopping they use will increase gradually in the near future, older adult because of teeth problems, need using various ways of cooking softens food when their ate but involve cooking skill, food purchase inconvenience often rely on others for help instead of own decisions, easily trended to monotonous diet and limited the food choice. Bases on current study, the convenience and quantity both important for older adult. For instance, have an organization of "CUT GOOD" provide service on prepared food for consumer and delivery service when on online purchases at, as everything of ingredient cut up already before cook. This is a business opportunity, because this way by far there are only the few people focus on this field will become with development potential. Government and companies should consider these difficulties to propose solutions benefiting the people improve the quality of diet and live happily.

5.1.2 Suggestion to Practice

According to the current health trends, restaurant companies to creative their menus accord with demand of health need among older Taiwanese adults. Sometime older Taiwanese adult have a meal to eat out, in order to food choice for their lack intake of food group, utilized the simple dietary diversity score display in menus may resolve barriers to using labelling information (Auchincloss, Young, Davis,

Wasson, Chilton, & Karamanian, 2013) but shape and color alternate DDS. For example, drawing the square with different color display 6 food groups and servings on menus like a circle with blue color is one serving of dairy in meal as well as the different color design consider base on dietary guidelines . In addition, colors and square help consumer quickly understand the information and clear compared with the text, especially older adults. Through simple dietary diversity score combination with color of menus labelling design people will make a healthier decisions and freedom of dietary choice for older Taiwanese adult.

5.2 Conclusion

Along with accelerating of aging society and living standard improving, people began to attaches great importance to the regimen. The propose of this study to understanding older Taiwanese adult to obtain an overview of the simple food intake through the TPB. Therefore, the current study shown that all older Taiwanese adult have higher DDS indicate better dietary quality, it is a good phenomenon. In order to increase consumption of dairy products, should suggest that how to use dairy products in their daily diet. On the other hand, Subjective Norms is most influence variety of diets on older adult, should encouraged they go out to participate community activities also improve their social skills and that professional will update the useful information was true about dietary diversity, family member who preparation or purchase the food should pay a attention in which the food group they lack of consumer. Moreover, attitude does not significantly influence the behavior, it may lack of perception of dietary diversity, so if get more information that they will proactive to a healthy diet. Hence, these results enable the development of relevant strategies to facilities older Taiwanese adult to healthy lifestyle if have a healthy body that life will be happiness.

5.3 Limitation & Future Study

There are a number of limitations associated with the current research that should be considered when interpreting the results. First, limitation of cost and time, this study used a convenience sample and was conducted in Central Taiwan, so the findings may no generalized or totally applicable to entire mature solitary population in Taiwan. Second, food intake of six food group to count the DDS per day was let them think back to what they ate each food group yesterday and explanation the questionnaire content with poster which more or less has some errors. Third, This may meet up with challenges when translation error, because of older adult almost got to say Taiwanese when explanation and some older adult couldn't see clearly or difference of education were lead to translation error.

Future study were bases on these limitations, need to more large survey sample in individual level to observe the differences of all districts. DDS in this study only investigate simple integrity of food groups and although the DDS was higher but no sure they have enough ate for each food group basis on recommendations of daily, details will be further discussions. Bases on translation error will need spoken Taiwanese training before the issuing questionnaires

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APPENDIX A – QUESTIONNAIRE

先生/小姐　您好：

感謝您的撥空填寫，本問卷是在探討銀髮族多樣性飲食的相關議題，整份問卷分為 5 個部分共 28 題，填答採匿名方式進行，您在問卷中所填答的資訊，僅作為學術研究之用，不再提供其他單位使用，敬請安心填寫。謝謝您的填寫與協助！

敬祝　身體健康，順心如意！

東海大學餐旅管理研究所
指導教授：李貴宜 博士
研究生　：鄭羽萱
Email :

一、個人基本資料：(請依照您的實際情況在□內打✓)

1. 性別 ：□男 □女
2. 出生年 :（民國）_____年
3. 婚姻狀況 ：

□已婚 □喪偶 □同居 □離婚 □未婚

4. 教育程度 ：

□不識字 □小學 □國中 □高中職 □專科大學(含)以上

5. 居住狀況 ：

□只有夫妻兩人同住 □自己一人獨居 □與他人同住（親人、幫傭等）

6. 最常以什麼方式來解決三餐？

□家中成員準備（家人、幫傭） □自己準備 □外食

***請確認所有問題皆回答完畢 非常感謝您的耐心填寫。**

二、飲食多樣性分數問卷： (以下每個題項中，請您回想昨天一整天有/沒有吃/喝到六大類食物**半份的份量**；☑勾選一個符合您情況的答案。)

請問您昨天一整天_____有吃/喝到半份的份量嗎？	有	沒有
1. ____全穀根莖類 (例如：至少半份米飯)	☐	☐
2. ____蔬菜類（例如：至少半碗的蔬菜）	☐	☐
3. ____豆魚肉蛋類（例如：至少 1 格半的傳統豆腐或半份魚肉或半份瘦肉或半顆蛋）	☐	☐
4. ____油脂與堅果種子類 (例如：至少 1 茶匙半的食用油或 5 顆花生)	☐	☐
5. ____乳製品類 (例如：至少半杯的牛奶或 1 片起司)	☐	☐
6. ____水果類 (例如：至少半根的香蕉)	☐	☐

*請確認所有問題皆回答完畢 非常感謝您的耐心填寫。

三、飲食多樣性態度問卷：(以下每項題目皆描述您對飲食多樣性攝取的態度，☑勾選一個符合您實際情況的答案，（1）代表非常不同意，數字越大表示越同意該題的描述。)

我想去多樣性飲食，因為	非常不同意（1）	不同意（2）	無意見（3）	同意（4）	非常同意（5）
1. ____可以保持身體健康	□	□	□	□	□
2. ____可以吃/喝到各種類的食物	□	□	□	□	□
3. ____食物的選擇性更多	□	□	□	□	□
4. ____食物的顏色、味道變化多吸引我去吃/喝	□	□	□	□	□
5. ____可以攝取到多種維生素與礦物質	□	□	□	□	□

*請確認所有問題皆回答完畢 非常感謝您的耐心填寫。

四、飲食多樣性主觀規範問卷：(以下每項題目皆描述影響您對飲食多樣性的攝取，☑勾選一個符合您實際情況的答案，（1）代表非常不同意，數字越大表示越同意該題的描述。)

____會影響我去吃/喝多樣性食物	非常不同意（1）	不同意（2）	無意見（3）	同意（4）	非常同意（5）
1. 家人	□	□	□	□	□
2. 專業人士（例如：醫師、營養師）	□	□	□	□	□
3. 媒體（例如：電視報導、廣告、廣播電台）	□	□	□	□	□
4. 朋友	□	□	□	□	□
5. 團體（活動中心、社區等）	□	□	□	□	□

*請確認所有問題皆回答完畢 非常感謝您的耐心填寫。

五、飲食多樣性知覺行為控制問卷：(以下每項題目皆描述當您在飲食多樣性的攝取與取得上，所感受到的阻礙，☑勾選一個符合您實際情況的答案，（1）代表非常不同意，數字越大表示越同意該題的描述。)

沒辦法去多樣性飲食，因為	非常不同意（1）	不同意（2）	無意見（3）	同意（4）	非常同意（5）
1. ____準備過程中，需多樣性食材、分類清洗、烹煮，浪費時間	□	□	□	□	□
2. ____要多樣性的購買食材，很麻煩	□	□	□	□	□
3. ____牙齒不好，造成選擇上有限制	□	□	□	□	□
4. ____沒有交通工具去購買食材	□	□	□	□	□
5. ____需一次性購買多樣食材，容易造成食材過量的採買	□	□	□	□	□
6. ____預算不足以支付每天購買多樣性食材	□	□	□	□	□

*請確認所有問題皆回答完畢 非常感謝您的耐心填寫。

APPENDIX B – PANEL REVIEW

問卷題項呈現方式

本研究問卷分成五個部分：

（一）人口統計：基本資料的填寫，共計6題。

（二）飲食多樣性分數：計分方式現場解說以海報圖示及器具呈現；每一大類的圖示和題目問項以平日常吃之食物為例，且標明最低建議量食用份量。請長輩們回想昨天一天內所食之六大類，每一大類有達到飲食建議之最低建議量即得該類一分，共計6分。（如：肉魚豆蛋類，一天總計最低建議量為4份，因此圖示中一隻手掌大的份量為2份，有吃到2隻手掌的份量，該類即得分。）

（三）態度：主動去多樣性飲食的因素，因此大題問項為「我想去多樣性飲食，因為……」，共計5題。

（四）主觀規範：受到誰的影響而去多樣性飲食。大題問項為「誰會影響我去吃/和多樣性食物？」，共計4題。

（五）知覺行為控制：將進行多樣性飲食時，預知到會受到的阻礙。大題問項為「無法進行多樣性飲食，因為……」，共計5題。

目的都在瞭解填答者多樣性飲食之攝取狀況。煩請審閱並加以指正，非常感謝您的協助。

（圖示：飲食多樣性分數）

專家效度審查評估表

台灣銀髮族之多樣性飲食攝取問卷

一、人口統計(Demographic)

題號	題目	選項	適合	修正後適合	不適合	修訂意見
1.	性別	□1.男 □2.女	□	□	□	
2.	出生年	（民國）_____年	□	□	□	年齡間距 例如：51-55 、56-60 歲...
3.	婚姻狀況	□1.未婚 □2.已婚 □3.同居 □4.離婚 □5.喪偶	□	□	□	填答者方便性建議順序調答 （1）已婚 （2）喪偶 （3）同居 （4）離婚 （5）未婚 可以考慮問伴侶的□有 □無 □1. 未婚 □2. 已婚 □3. 其它
4.	教育程度	□1.國中（含）以下 □2.高中(職) □3.專科大學 □4.研究所（含）以上	□	□	□	新增 國小?? 建議增加”不識字”
5.	居住狀況	□1.與子女同住 □2.夫妻同住 □3.獨居	□	□	□	2. 只夫妻兩人同住 3. 自己一人獨居 4. 與幫傭夫妻三人同住 5. 自己與幫傭二人同住 子女可以晚輩代替 ex. 孫… 是否有與他人（親人或友人）或看護同住的可能？是否考慮加 4. 其他 新增 「與子女、孫子、夫妻同住」、「與孫子、夫妻同住」、「與孫子同住」

6.	飲食狀況	□1.家人準備 □2.自己煮 □3.朋友鄰居準備 □4.幫傭準備 □5.外食	□	□	□	若是一天三餐中有一餐或是二餐自備或是外食（購），此題要如何勾選，是複選題嗎？ 1. 自己煮建議改為自己準備 2. 建議增加”送餐服務”

↑建議新增：受訪者是否有慢性病?? 牙齒狀態

二、飲食多樣性分數(Dietary Diversity Score)

題號	題目	選項	適合	修正後適合	不適合	修訂意見
1.	請問您昨天有吃/喝全穀根莖類？ (例如：2 碗的米飯)	□1.有 □2.沒有	□	□	□	此問題應明確問每餐的量或是一天總計攝取量。 全穀「根莖類」類是否容易造成誤解？ 問題需釐清:只要有吃就可勾選有，還是必須吃到至少 2 碗的米飯的量?
2.	請問您昨天有吃/喝蔬菜類？ （例如：1 碗半的蔬菜）	□1.有 □2.沒有	□	□	□	若要喝的，要舉例指出等份換算。 同上
3.	請問您昨天有吃/喝豆魚肉蛋類？ （例如：蛋 1 個、豆腐 1 塊、魚肉 1 份、瘦肉 1 份）	□1.有 □2.沒有	□	□	□	喝是指什麼？ 同上

4.	請問您昨天有吃油脂與堅果種子類？ (例如：3 茶匙的食用油)	□1.有 □2.沒有	□	□	□	同上 分成二題 請問您昨天有吃油脂類(例如：3 茶匙的食用油)？ 請問您昨天有吃堅果種子類(例如：00)？
5.	請問您昨天有吃/喝低脂乳品類？ (例如：1 杯半的牛奶)	□1.有 □2.沒有	□	□	□	同上。另外，為何只有低脂乳品？其中全脂或無脂包含在內嗎? 分成二題 請問您昨天有吃/喝乳品類？(例如：1 杯半的牛奶) 請問您昨天是吃/喝低脂乳品類？(例如：1 杯半的牛奶)
6.	請問您昨天有吃/喝水果類？(例如：2 顆的蘋果)	□1.有 □2.沒有	□	□	□	2 份純蘋果汁 同上 喝

建議 1：是否細分出有吃但未達標準量的填答題或是超出標準量的選項？目前有或無的選項恐在訪問時會遇到相當的困難。

建議 2：DDS 的份量與李美璇教授所發表之 paper 定義不同，是否可以使用，請再確認。

三、態度(Attitude)

題號	題目	選項	適合	修正後適合	不適合	修訂意見
1.	可以保持身體健康	□1.非常不同意 □2.不同意 □3.中立 □4.同意 □5.非常同意	□	□	□	“中立”改為“無意見”是不是老年人較為看得懂？ 好像少了一些說明，什麼可以保持身體健康？ 什麼可以保持身體健康？請

						用完整句敘述! 是否用七點量表
2.	可以吃/喝到各種類的食物	□1.非常不同意 □2.不同意 □3.中立 □4.同意 □5.非常同意	□	□	□	同上 是否用七點量表
3.	食物的選擇性更多	□1.非常不同意 □2.不同意 □3.中立 □4.同意 □5.非常同意	□	□	□	同上 是否用七點量表
4.	食物的顏色、味道變化多吸引我去食用	□1.非常不同意 □2.不同意 □3.中立 □4.同意 □5.非常同意	□	□	□	同上 是否用七點量表
5.	可以攝取到所需的維生素	□1.非常不同意 □2.不同意 □3.中立 □4.同意 □5.非常同意	□	□	□	同上 是否用七點量表 建議改為“可以攝取到多種維生素與礦物質”

四、主觀規範(Subjective Norms)

題號	題目	選項	適合	修正後適合	不適合	修訂意見
1.	家人	□1.非常不同意 □2.不同意 □3.中立 □4.同意 □5.非常同意	□	□	□	好像也少了什麼說明 ___ 的意見會影響我？ 請用完整句敘述 是否用七點量表
2.	專業人士（例如：醫師、營養師）	□1.非常不同意 □2.不同意 □3.中立 □4.同意 □5.非常同意	□	□	□	同上 是否用七點量表
3.	電視（例如：報導或廣告）	□1.非常不同意 □2.不同意 □3.中立 □4.同意 □5.非常同意	□	□	□	媒體（例如：電台、網路資訊） 同上 是否用七點量表
4.	朋友、社區團體	□1.非常不同意 □2.不同意 □3.中立 □4.同意 □5.非常同意	□	□	□	同上 是否用七點量表

五、知覺行為控制(Perceived Behavior Control)

題號	題目	選項	適合	修正後適合	不適合	修訂意見
1.	準備多樣性食物過程中，需分類清洗、烹煮，很浪費時間	□1.非常不同意 □2.不同意 □3.中立 □4.同意 □5.非常同意	□	□	□	可考慮將“浪費時間”改為“很麻煩”。老人家大多不怕浪費時間但怕麻煩。 是否用七點量表
2.	牙齒不好，很多食物都不能吃	□1.非常不同意 □2.不同意 □3.中立 □4.同意 □5.非常同意	□	□	□	是否用七點量表
3.	沒有交通工具去購買食材	□1.非常不同意 □2.不同意 □3.中立 □4.同意 □5.非常同意	□	□	□	是否用七點量表
4.	需一次性購買多樣食材，容易造成食材過量的採買	□1.非常不同意 □2.不同意 □3.中立 □4.同意 □5.非常同意	□	□	□	是否用七點量表
5.	預算不足以支付每日多樣性食材的購買	□1.非常不同意 □2.不同意 □3.中立 □4.同意 □5.非常同意	□	□	□	是否用七點量表

問題建議：沒有人幫忙煮來吃的人，只能吃外購或是被動吃別人煮好食物的人要選哪一題？

建議：+6.食量不大，無法吃到這麼多。

非常感謝您的修正與協助！

TUNGHAI UNIVERSITY
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