科技部補助專題研究計畫成果報告
期末報告

台灣經濟弱勢家庭中兒童與青少年的體重狀態：糧食匱虞與飲食行為影響的性別差異

計 畫 類 別 ： 個別型計畫
計 畫 編 號 ： MOST 107-2629-B-006-001-
執 行 期 間 ： 107年08月01日至108年07月31日
執 行 單 位 ： 國立成功大學醫學系小兒科

計 畫 主 持 人： 蔡孟哲
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計畫參與人員： 大專生-兼任助理：Camilla Meshki
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中 華 民 國 108 年 10 月 04 日

中 文 摘 要 ： 諸多亞州國家的肥胖盛行率逐漸增加中，也同時逐漸被認為是新興的公共衛生議題，而儘管國家經濟成長，糧食匱虞的定義為有限的或者不確定可取得足夠營養與安全的食物，仍是許多貧窮次人口群常面臨的重大困難，過去研究關於糧食匱虞與肥胖的相關性結果並不一致，僅在女性較男性比較一致性地觀察到正相關性，本項研究意圖釐清糧食匱虞、飲食行為、與體重狀態的關係，同時也做性別分層分析，資料來自於台灣貧窮兒少資料庫，參與者(共有1326人)年齡介於10至18歲(時間2009至2013年)，共包含三波測量糧食匱虞與飲食行為的調查，體重狀態以自述身體質量指數(公斤/公尺平方)決定，體重過重/肥胖組定義為身體質量指數高於代表性人口的第85百分位，邏輯式迴歸分析指出糧食匱虞與體重過重/肥胖之間有顯著相關性，勝算比1.45，95%信賴區間1.25-1.70，糧食匱虞也與某些不健康飲食行為相關，在女性不吃早餐(勝算比1.63，95%信賴區間1.20-2.22)，而在男性食用點心飲料(勝算比1.51，95%信賴區間1.15-1.98)與體重過重/肥胖相關，經校正飲食行為後，糧食匱虞仍顯著地與體重過重/肥胖相關，此外也有一些證據顯示飲食行為中介糧食匱虞與體重過重/肥胖之間的相關性，總結來說，經濟弱勢年輕人容易有糧食匱虞與肥胖問題，而由於飲食行為的關係，糧食匱虞可能增加肥胖的可能性，了解這些糧食匱虞與肥胖的中介因子可能有助於改善受貧窮影響人口群的體重相關問題。

中 文 關 鍵 詞 ： 糧食匱虞、貧窮、飲食行為、肥胖、性別

英 文 摘 要 ： Across many Asian countries, the prevalence of obesity is increasing and is increasingly recognized as an emerging public health issue. Food insecurity, defined as the limited or uncertain availability of nutritionally adequate and safe foods, is major difficulty faced by many poor subpopulations despite national economic growth. Previous research has yielded inconsistent results about the association between food insecurity and obesity, with positive associations more consistently observed among women than men. This study aims to elucidate relationships between food insecurity, dietary behaviors, and weight status, stratified by gender. Data come from the Taiwan Database of Children and Youth in Poverty. Participants (n=1326) aged 10-18 years (2009-2013), which included measures of food security and dietary behaviors in three survey waves. Weight status was determined using self-reported body mass index (BMI; kg/m2) with the category “overweight/obesity” defined as a BMI above the 85th percentile within a representative population. Logistic regression analyses indicated a significant association between food insecurity and obesity/overweight with an odds ratio (OR) = 1.45, 95% confidence interval (CI) 1.25-1.70. Food insecurity was associated with a select number of unhealthy dietary behaviors. Skipping breakfast in females (OR = 1.63, 95% CI 1.20-2.22) and consuming snacks and

sugared drinks in males (OR = 1.51, 95% CI 1.15-1.98) were associated with obesity/overweight. Food insecurity remained significantly associated with obesity/overweight after adjusting for dietary behaviors. In addition, there was some evidence that dietary behaviors medicated the association between food security and obesity/overweight. In conclusion, economically disadvantaged youth are vulnerable to food insecurity and obesity, and food insecurity may increase the likelihood of obesity due to its association with dietary behaviors. Understanding the mediating factors between food insecurity and obesity may help to amend weight-related health problems in poverty-affected populations.

英文關鍵詞：Food insecurity, poverty, dietary behaviors, obesity, gender

附件一

科技部補助專題研究計畫成果報告

（□期中進度報告/■期末報告）

台灣經濟弱勢家庭中兒童與青少年的體重狀態：糧食匱虞與飲食行為影響的性別差異

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執行機構及系所：國立成功大學醫學系小兒學科

計畫主持人：蔡孟哲
共同主持人：莊佳蓉
計畫參與人員：吳昶翰、Camilla Meshki

本計畫除繳交成果報告外，另含下列出國報告，共 0 份：
□執行國際合作與移地研究心得報告
□出席國際學術會議心得報告
□出國參訪及考察心得報告

中　華　民　國　108　年　10　月　04　日

Abstract

Backgrounds/Objectives: Across many Asian countries, obesity is an emerging public health issue with an incessantly elevating prevalence. Food insecurity, the limited or uncertain availability of nutritionally adequate and safe foods, is one of the major socioeconomic difficulties faced by the poor subpopulation despite national economic growth. Previous research yields inconsistent results on the association between food insecurity and obesity with gender effect being scarcely addressed. This study aims to examine the hypothesis that food insecurity is related to obesity under the differential influence of gender differential dietary behaviors.

Design/Methods: The longitudinal data were retrieved from the Taiwan Database of Children and Youth in Poverty (TDCYP). Participants (n=1326) aged 10-18 years (2009-2013) were requested to answer questions on concerns of food security and dietary behaviors in three waves of survey. Weight status was defined by self-reported body mass index with the category "overweight/obesity" being >85th% of representative population. We applied multiple logistic regression analyses to elucidate gender-stratified relationship among food insecurity, dietary behavior, and weight status.

Results: We found a statistically significant association between food insecurity and obesity/overweight with odds ratio (OR) =1.45, 95% confidence interval (CI) 1.25-1.70. Food insecurity was associated with a select of unhealthy dietary behaviors. Meanwhile, skipping breakfast in females (OR = 1.63, 95% CI 1.20-2.22) and consuming snacks and sugared drinks in males (OR = 1.51, 95% CI 1.15-1.98) were associated with obesity/overweight. Taking food insecurity and dietary behaviors together in a full logistic regression model, food insecurity remained significantly associated with obesity/overweight as well as an indirect link mediated by the influence of dietary behaviors.

Conclusion: Economically disadvantaged youths are vulnerable to food insecurity and obesity, both factors being significantly related. Gender differential dietary behaviors mediate this relationship. Understanding mediating factors may help to amend the weight-related health problems in the poverty-affected population.

Keywords: Food insecurity, poverty, dietary behaviors, obesity, gender

Introduction

The prevalence of overweight/obesity in children and adolescents has been a global concern and continues to rise in some developing countries.[1] There have been remarkable changes of lifestyles and dietary behaviors, owing to economic growth,[2] that are meanwhile assumed to be the main causes of major non-communicable diseases of great health burden, such as obesity, diabetes mellitus, and cardiovascular diseases.[3] Taiwan is no exception with its rapid process of industrial development and economic growth in the last century; a large survey has shown that metabolic risks are common among elementary schoolchildren with the prevalence of more than two abnormal metabolic parameters being 12.2% for boys and 21.6% for girls.[4, 5] Despite the accumulation of social wealth, health inequality still prevails with health problem disproportionately concentrated in poor socioeconomic strata.[6] Obesity in youths that is an example with a higher incidence found in the socioeconomically disadvantaged population will be the focus of investigation based on a social justice framework.[7]

Growing up in low-income households and communities poses many threats and challenges to one's health. As *household production theory* posited, children's health outcomes result from the allocation of parental resources.[8] In a financially strained situation where a household budget that is stretched because of limited incomes needs to pay for housing, education, clothing and health care, families are very likely to be restrained from consuming nutritionally adequate and safe foods or changing dietary behaviors.[9] As access to sufficient and nutritious food is one of fundamental human rights, food insecurity is usually defined by the lack of access at all times to sufficient, safe, and nutritious food to maintain a healthy and active life.[10] In the United States, it is estimated that 20% of adolescents or 40% of economically disadvantaged adolescents live in food-insecure households.[11] A recent report on younger children conducted in UK has also shown that food insecurity was perceived as a problem in more than 40% of the nursery managers, an even higher rate found in most deprived area.[12] From a life course perspective, food insecurity has been extensively implied in the association with adverse health and developmental outcomes in youths, including impeded academic achievement[13], behavioral problems[14], occurrences of mood and anxiety disorders[15], substance use[16], as well as obesity.[7]

Substantial evidence indicates that dietary patterns that are high in energy-dense, high-fat and low-fiber foods predispose children and adolescents to later overweight and obesity.[17] Corresponding to this link, a prior study found that Californian children experiencing food insecurity consumed more obesogenic diets, such as higher fat and saturated fat intakes, sweets, and fried snacks than children not experiencing food insecurity.[18] However, the Mexican counterparts with food insecurity tended to have lower intake of total carbohydrates.[18] The findings on the link between food insecurity and childhood obesity may be varied according to the social context where exists different obesogenic exposures. As such, some studies reported lack of association[19-21] and even an inverse relationship[22]. The disparity in the relationship between food insecurity and obesity may thus rely on availability of foods and patterns of consumption.[23] Meanwhile, gender disparity has been recognized in the association between exposure to childhood poverty and obesity in young adulthood.[24] Whether this difference is pertinent to gender differential dietary behaviors remains unknown.

According to the abovementioned, this study aimed firstly to examine the relationship between food insecurity

and weight status and secondly to explore possible mediating roles of gender differential dietary behaviors in this relationship among economically disadvantaged Taiwanese youths.

Methods

Study population

Data for analysis were retrieved from the Taiwan Database of Children and Youth in Poverty (TDCYP) study, which was conducted by the Taiwan Fund for Children and Families (TFCF). The dataset comprised a nationally representative cohort of children and youths in families receiving governmental subsidies or social services provided by TFCF. The details of TDCYP study has been described elsewhere.[25, 26] The survey took place biennially until the recipients of subsidies or services were disqualified. The present study used subset of data on the 1,326 children and adolescents that completed all relevant questions throughout the initial three waves (wave 1 in 2009, wave 2 in 2011, and wave 3 in 2013) of data collection for analysis. The study was approved by the Institutional Review Board of the National Cheng Kung University Hospital.

Measures

Weight status

Participants' weights and heights that were self-reported at wave 3 were used to calculate the body mass index (BMI), which was operated as proxy of weight status in this study after being standardized against the national age- and sex-matched representative norms.[27] For analytic purpose, weight status was treated as categorical outcome variables, i.e. underweight (<5th% of representative population), normal-weight (between 5th% and 85th% of representative population), and overweight/obesity (>85th% of representative population).[27]

Food insecurity

According to the original Core Food Security Module that was developed by the US Department of Agriculture and consisted of dichotomous items assessing access to food, modified eating behavior, concerns about food availability and hunger levels within the past year[28], Wang et al constructed a similar measure that was tailored considering the availability of data in TDCYP[25]. The construct that we applied in this study included four items: eating less than 3 meals and no other snacks in a day, experiencing hunger because of shortage of money, skipping breakfast or lunch because of saving money, and financial difficulties to pay for lunch. The sum of dichotomized answers to these questions represents the levels of food insecurity with a higher score corresponding to higher food insecurity.

Dietary behaviors

Items relevant to dietary behaviors were extracted, including healthy and unhealthy practices.[26] Items corresponding to healthy dietary behaviors included those assessing the frequency of fruits and vegetables consumed in a week and regularity of having breakfast. Items assessing unhealthy eating included frequency of snacks and sugared drinks consumed in a week. The answers were collapsed into "1 time/week or less", "2-3 times/week", and "4 times/week or more". For analytic purpose, we recoded into an ordinal scale from 1 to 3 with a reverse direction applied to healthy dietary behaviors to create a score representing unhealthy eating practices. Scores on each item of the dietary behaviors were averaged using the values assessed at waves 1 and 3.

Covariates

Demographic characteristics

We included a comprehensive set of demographic characteristics that include age, gender (male and female), urbanicity of living area (city, town, and rural), parental educational years, and family structure (two-parent, single-parent, and others). Monetary household incomes and self-rated affluence of disposable money were also adjusted as covariates.

Statistical analysis

Descriptive statistics were used to describe the demographic information of analyzed subjects. Logistic regression analyses were conducted to clarify the link between food insecurity and weight status. Specifically, the univariate link between food insecurity and weight status was initially examined using multinomial regression analysis with the normal-weight group as the reference. Second, linear regression analyses were applied to assess the link between food insecurity and dietary behaviors. Further, food insecurity and dietary behaviors were simultaneously included in the regression analyses with the weight status as the outcome variable. The mediation effect of the dietary behaviors on the aforementioned link between food insecurity and weight status was examined using the bootstrap method. We conducted statistical analyses using SPSS V.17.0 (SPSS, Chicago, Illinois, USA).

Results

The mean age of the analyzed subjects (690 were males) was 15.00 (±1.31) years at wave 3 (Table 1). Weight status was divided into three groups “underweight (10%)”, “normal (64%)”, and “overweight/obesity (26%)”. The proportions for overweight/obesity and underweight were both higher in males than in females (p=0.002). Only 22.5% of this cohort lived with both parents and nearly 53% had monthly household income less than 15000 NTD. Nevertheless, 65.1% of subjects still had pocket money in their daily life.

Using a multinomial regression model (Table 2), we demonstrated that food insecurity predicted a higher incidence of overweight/obesity (odds ratio [OR] =1.46, 95% confidence interval [CI] 1.25-1.70). A similar relationship was found after stratification by gender and a stronger OR was found in females. Contrarily, there was no significant link between food insecurity and the occurrence of underweight.

The association between each dietary behavior and weight status was examined separately (Table 3). Skipping breakfast and consuming snacks and sugared drinks were both positively associated with overweight/obesity. Gender difference was noted in that skipping breakfast (OR =1.63, 95%CI 1.20-2.22) was associated with overweight/obesity in females only and consuming snacks and sugared beverages (OR = 1.51, 95%CI 1.15-1.98) was associated with overweight/obesity in males only.

Further, the correlation between food insecurity and each dietary behavior was statistically significant (Table 4). Particularly, skipping breakfast ($\beta = 0.32$, 95%CI 0.19-0.27) and eating fewer vegetables ($\beta = 0.16$, 95%CI 0.08-0.17) were strongly correlated with food insecurity.

In the multivariate models (Table 5), the association between food insecurity and overweight/obesity remained statistically significant in the entire sample and the subgroups stratified by gender. The bootstrap

method revealed the mediation effects of consuming snacks and sugared drink in the association of food insecurity and overweight/obesity for the entire and male samples. The mediation effect of skipping breakfast in the association of food insecurity and overweight/obesity was shown for the female sample (Table 6). The results indicated the presence of mediation effect of each individual dietary behavior.

Discussion

Our study was the first, to our knowledge, to characterize the link between food insecurity and weight status in economically disadvantaged youths from a national sample in Taiwan. We found that food insecurity was a common experience in this cohort and a comparable rate of overweight/obesity as compared to general age-matched population.[27] Furthermore, a consistent correlation existed between food insecurity and overweight/obesity wtih rigorous statistical analysis. Besides, interesting findings regarding gender differences in the mediation effect of dietary behaviors linking food insecurity and overweight and obesity were identified. Hopefully these discussions could help tackle the emerging issue of obesity in this particular socioeconomic stratum.

Similar to previous studies that were conducted in the United States[7, 29], our results showed a significant link between food insecurity and overweight/obesity, while no significance was found in the link to underweight. This finding was contrary to a general understanding that food insecurity may lead to instable access to nutrition required for growth, thus causing underweight problems.[30] We did find a higher percentage of underweight in these economically disadvantaged youths than the general population[27, 31], but the occurrence of underweight was not explainable by food insecurity. On the other hand, our results further consolidated the relationship between food insecurity and overweight/obesity in youths. Nearly 70% of the households had experienced at least one form of food insecurity, which could be translated into 45% increase in odds of obesogenicity. Beyond the issue of food security, other individual-level and community-level factors, such as eating habits, physical illness, and household hygiene, may all contribute the overall nutrition status.[32] Previous discussion on the link between food insecurity and obesity in children and adolescents attributed its cause to limited access to healthier and less energy-dense foods and disinhibited eating when foods available.[22, 23, 33] A prior study situating the issue of food insecurity in the Taiwanese context found that familial disruption and material hardship were most likely associated with food insecurity in youths.[25] Given that the level of material hardship involves the allocation of available familial resources, including food choices,[8] we further examined the mediating role of dietary behaviors in the positive link between food insecurity and overweight/obesity.

Dissecting the relationship between dietary behaviors and food insecurity, we found that food-insecure individuals tend to have adverse dietary behaviors: skipping breakfast, eating less vegetables, and consuming snacks and sugared drinks. However, only skipping breakfast (particularly in females) and consuming snacks and sugared drinks (in males) were associated with overweight/obesity. Gender difference in the link between these dietary behaviors and occurrences of overweight/obesity has also been noted in previous research.[34, 35] In an experimental study, Painchaud Guérard et al found that male participants tended to have higher levels of desire to eat as well as hunger and prospective food consumption, while female counterparts could feel more easily satiated.[35] We argue that this gender discrepancy in response to satiation may explain the differential link between eating behaviors and food insecurity. In the peril of food insecurity, a low threshold of satiety

may result in restrictive eating or complete meal skipping. Breakfast has been reported the most commonly skipped meal of the day, particularly for girls in low-income households.[36] Contrarily, males would turn to consume calorie-dense and usually less expensive foods to satiate their hunger, which may be related to undernutrition or worries about consistent food supply because of poverty.[33] Whichever the measures female and male youths adapted to food insecurity, these behaviors, except the intakes of fruits and vegetables, were linked to overweight/obesity in this cohort. An insignificant association between the consumption of fruits and vegetables and overweight/obesity may be confounded by how these green foods are prepared. Once the vegetable is deep fried with large amount of oil, which may be a common culinary practice in Taiwan, the high calories are expected when consumed and thus linked to overweight/obesity.

In the final full models with dietary behaviors controlled, food insecurity remained as a significant predictor of overweight/obesity with a higher likelihood in females. This finding stands in line with previous studies on the adult population, where women are more vulnerable to the risk of overweight and obesity in food-insecure situations.[24, 37] Further constructing a mediation model to analyze the role of dietary behaviors, we found that skipping breakfast in females and consuming snacks and sugared drinks in males mediated the link between food insecurity and overweight/obesity. Our results supported previous notion that food insecurity may shape individual dietary behaviors towards unhealthy practices that are highly correlated with occurrences of overweight and obesity.[22, 33] In an US study, it has been suggested that participation in food assistance programs may attenuate the negative impacts of food insecurity on the risks of obesity in school-aged children.[38] Girls in food-insecure families who participated in National School Lunch Program were less likely to be obese compared to food-insecure girls who were not in the program.[39] Situating our findings in the local social context in Taiwan, where publicly funded free school lunch is provided to economically disadvantaged youths,[40] we clearly demonstrated that health inequality regarding weight status was however not eliminated across difference levels of food security. Public health sectors should instead promote self-awareness and self-efficacy on the importance of adopting healthy dietary behaviors, like having breakfast regularly and avoiding calorie-dense foods, among the vulnerable populations.

From the social justice perspective, vulnerable populations are most at risk for food insecurity and struggle the most with access to resources. Food insecurity can be identified as a social justice issue because of a lack of access to nutritious food and a problem of inequality that affects disadvantaged and vulnerable populations disproportionately in society. General public usually think about food insecurity mainly in terms of hunger. However, food security should not solely focus on the sufficient food to prevent individuals from hunger, but also must emphasize the access to nutritious food and dietary behaviors. In order to effectively increase food security for vulnerable populations, Seipel et al indicated four main action areas: build awareness and interest, promote principles of human rights, oppose harmful cultural practices against women, and increase community participation.[39] Increasing public participation will improve efforts to promote food security, which ultimately helps tackle health inequality. If physicians, educators, social works, and other professionals become more aware of this issue both within the therapeutic relationship and on a societal level, they may be more likely to advocate for policies that support food security and nutrition among vulnerable populations, provide education to the vulnerable communities about the importance of the nutritious food and empower them to protect their rights to food, and provide alternative interventions such as community garden programs, and build coalitions of multiple stakeholders to address issues of food security.

Our study still had some limitation. First, the scale of food insecurity that could be bound by limited choices of questions only available in the dataset as proxy may be unable to comprehensively represent the entire aspects of food insecurity. This current construct has been validated and showed a significant correlation with the levels of material hardships.[17] Thus, this scale was somewhat reflective of the domains in food security most likely encountered in this local social setting. Second, the context for this longitudinal study was set within the journey of puberty where lifestyles and eating behaviors tremendously change. However, the variables regarding participants' physical/sedentary behaviors were generally lacking and hence not controlled in the analysis. Third, only three dietary behaviors were used in the model, which could be limited to represent more complicated eating patterns in real. Other food-related information, such as calories and types of food that could help identifying the specific dietary choices, was also not available in the original dataset. In order to obtain a clearer view of dietary and lifestyle behaviors in social-economical disadvantaged populations, further research with a focus on these factors is needed to briefly and clearly address this issue.

Conclusions

We found a common experience of food insecurity among the socioeconomically disadvantaged children and adolescents. The association between food insecurity and overweight/obesity was also remarkable in this group. This link may in part due to unhealthy dietary behaviors, such as skipping breakfast in females or consuming too much snacks and sugared drink in males. These findings could inform policy decision and health education programs targeted at the socioeconomically disadvantaged youths. We urge to recognize the issue of food insecurity and the association with weight problems, in order to eliminate the health inequality brought by poverty.

Table 1. Demographic information of participants

	Total (N=1326) N (%)	Male (N=690) N (%)	Female (N=636) N (%)	*p*-value
Age, mean (±SD)	15.0 (1.31)	15.0 (1.32)	15.0 (1.31)	0.673
Family structure				
Living with both parents	298 (22.5)	150 (21.7)	148 (23.3)	0.495
Others	1027 (77.5)	540 (78.3)	487 (76.7)	
Household monthly incomes				
0~15000 (NTD)	664 (53.3)	354 (55.0)	310 (51.6)	
15000~30000 (NTD)	529 (42.8)	256 (39.8)	273 (45.4)	0.032
>30000 (NTD)	52 (4.2)	34 (5.3)	18 (3.0)	
Pocket money				
No	460 (34.9)	240 (34.9)	220 (34.8)	0.962
Yes	859 (65.1)	447 (65.1)	412 (65.2)	
Weight status				
Underweight	132 (10)	82 (11.9)	50 (7.9)	
Normal weight	849 (64)	412 (59.7)	437 (68.7)	0.002
Overweight/obesity	345 (26)	196 (28.4)	149 (23.4)	
Food insecurity scale				
0	319 (25.7)	149 (23.1)	170 (28.4)	
1	519 (41.8)	289 (44.8)	230 (38.5)	
2	338(27.2)	174 (27.0)	164 (27.4)	0.093
3	60 (4.8)	31 (4.8)	29 (4.8)	
4	7 (0.6)	2 (0.3)	5 (0.8)	
Having breakfast				
1 time/week or less	76 (6.0)	36 (5.5)	40 (6.5)	
2-3 times/week	374 (29.6)	177 (27.2)	197 (32.2)	0.084
4 times/week or more	813 (64.4)	438 (67.3)	375 (61.3)	
Eating fruits and vegetables				
1 time/week or less	452 (34.5)	195 (28.7)	257 (40.7)	
2-3 times/week	639 (48.7)	349 (51.4)	290 (45.9)	<0.001
4 times/week or more	220 (16.8)	135 (19.9)	85 (13.4)	
Consuming snacks and sugared drinks				
1 time/week or less	226 (17.1)	125 (18.2)	101 (16.0)	
2-3 times/week	683 (51.8)	359 (27.2)	324 (51.2)	0.316
4 times/week or more	410 (31.1)	202 (29.4)	208 (32.9)	

SD represents standard deviation; NTD, New Taiwan Dollar

Table 2. Multinomial logistic regression analysis on the relationship between food insecurity and weight status

	Total	Male	Female
	OR (95% CI)	OR (95% CI)	OR (95% CI)
Model A: FIS treated as an ordinary scale			
Underweight	1.02 (0.81-1.29)	1.03 (0.76-1.40)	0.96 (0.67-1.40)
Overweight/obesity	1.45*** (1.25-1.70)	1.32* (1.06-1.65)	1.61*** (1.29-2.00)
Model B: FIS treated as a categorical variable			
FIS ≥1			
Underweight	1.16 (0.74-1.81)	1.35 (0.73-2.50)	0.85 (0.44-1.67)
Overweight/obesity	2.05*** (1.46-2.88)	1.63* (1.03-2.60)	2.59*** (1.56-4.34)
FIS ≥2			
Underweight	1.09 (0.64-1.85)	1.13 (0.55-2.34)	0.97 (0.44-2.12)
Overweight/obesity	2.35*** (1.61-3.42)	1.78* (1.06-3.00)	3.17*** (1.81-5.56)
FIS ≥3			
Underweight	0.88 (0.29-2.69)	1.21 (0.31-4.74)	0.50 (0.06-4.05)
Overweight/obesity	3.67*** (2.01-6.68)	2.67* (1.14-6.27)	5.06*** (2.15-11.90)

OR indicates odds ratio; CI, confidence interval; FIS, food insecurity scale; * p<0.05; ** p<0.01;***p<0.001

In model A, FIS was treated as an ordinary scale. In model B, FIS was treated as a categorical variable with the food-secure group (FIS =0) being the reference group. All the regression analyses were adjusted for family structure, household income, and pocket money status.

Table 3. Multinomial logistic regression [a] on the relationship between dietary behaviors and overweight/obesity

	Total	Male	Female
	OR (95% CI)	OR (95% CI)	OR (95% CI)
Skipping breakfast	1.35* (1.09-1.67)	1.16 (0.86-1.56)	1.63*** (1.20-2.22)
Eating less vegetables	1.04 (0.86-1.18)	0.97 (0.76-1.28)	1.03 (0.70-1.39)
Consuming snacks and sugared drinks	1.33*** (1.09-1.62)	1.51*** (1.15-1.98)	1.17 (0.87-1.56)

[a] Multinomial logistic included underweight and overweight/obesity with reference to normal-weight groups. Table only listed the results of overweight/obesity group. All the regression analyses were adjusted for family structure, household income, and pocket money status.

OR indicates odds ratio; CI, confidence interval; * p<0.05 ; ** p<0.01; ***p<0.001

Table 4. Linear logistic regression analysis on the relationship between dietary behaviors and food insecurity

	Total	Male	Female
	Beta (95% CI)	Beta (95% CI)	Beta (95% CI)
Skipping breakfast	0.32*** (0.19 , 0.27)	0.32*** (0.17 , 0.28)	0.32*** (0.17 , 0.28)
Eating less vegetables	0.16*** (0.08 , 0.17)	0.13*** (0.04 , 0.17)	0.19*** (0.08 , 0.21)
Consuming snacks and sugared drinks	0.06* (0.01 , 0.09)	0.08 (0.00 , 0.13)	0.06 (-0.02 , 0.10)

CI, confidence interval; * p<0.05 ; ** p<0.01; ***p<0.001

All the regression analyses were adjusted for family structure, household income, and pocket money status

Table 5. Multinomial logistic regression [a] on the relationship between food insecurity plus dietary behaviors and overweight/obesity

	Total OR (95% CI)	Male OR (95% CI)	Female OR (95% CI)
FI to weight status under D1 control			
Food insecurity	1.40*** (1.18 , 1.65)	1.28* (1.01 , 1.63)	1.50*** (1.18 , 1.90)
Skipping breakfast (D1)	1.18 (0.93 , 1.49)	1.07 (0.76 , 1.50)	1.37 (0.98 , 1.92)
FI to weight status under D2 control			
Food insecurity	1.45*** (1.24 , 1.70)	1.31* (1.05 , 1.63)	1.64*** (1.31 , 2.05)
Eating less vegetables (D2)	0.97 (0.79 , 1.18)	0.98 (0.75 , 1.28)	0.87 (0.64 , 1.18)
FI to weight status under D3 control			
Food insecurity	1.44*** (1.23 , 1.68)	1.29* (1.04 , 1.61)	1.60*** (1.29 , 2.00)
Consuming snacks and sugared drinks (D3)	1.33*** (1.09 , 1.64)	1.56*** (1.17 , 2.07)	1.14 (0.85 , 1.55)

[a] Multinomial logistic included underweight and overweight/obesity with reference to normal-weight groups. Table only listed the results of overweight/obesity group. All the regression analyses were adjusted for family structure, household income, and pocket money status.

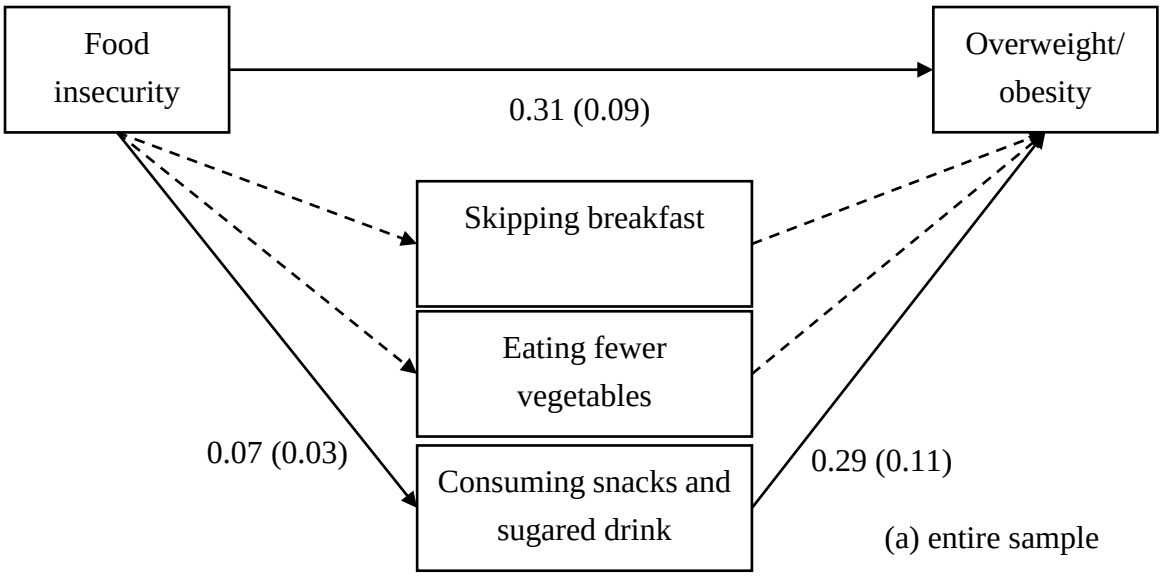
FI indicates food insecurity; OR, odds ratio; CI, confidence interval; * p<.05 ; ** p<0.01; ***p<0.001

Table 6. Bootstrap test on the mediation strength of dietary behaviors on the association between food insecurity and overweight/obesity

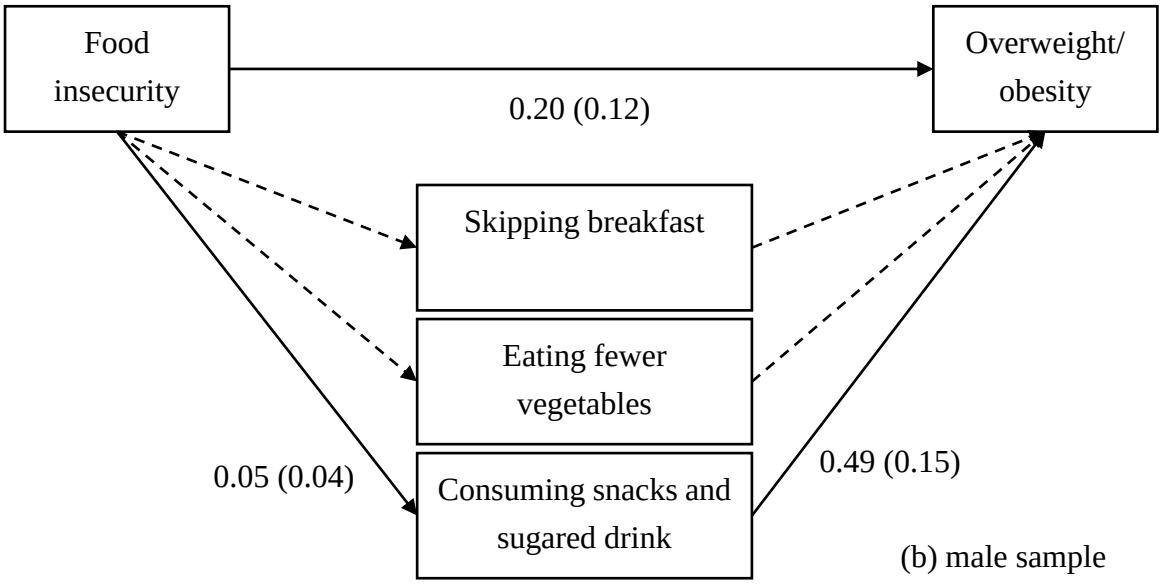
	Total		Male		Female	
	(Effect , SE)	(95% CI)	(Effect , SE)	(95% CI)	(Effect , SE)	(95% CI)
Direct effect						
Food insecurity	(0.31 , 0.09)	(0.14 , 0.48)	(0.20 , 0.12)	(-0.05 , 0.44)	(0.42 , 0.13)	(0.18 , 0.67)
Indirect effect						
Skipping breakfast	(0.04 , 0.03)	(-0.01 , 0.10)	(0.01 , 0.04)	(-0.59 , 0.09)	(0.08 , 0.04)	(0.01 , 0.17)*
Eating fewer vegetables	(-0.01 , 0.02)	(-0.04 , 0.02)	(0.00 , 0.02)	(-0.35 , 0.29)	(-0.03 , 0.03)	(-0.09 , 0.01)
Consuming snacks and sugared drink	(0.02 , 0.01)	(0.01 , 0.04)*	(0.03 , 0.02)	(0.01 , 0.08)*	(0.00 , 0.01)	(-0.01 , 0.04)

SE indicates standard error; CI, confidence interval; *p<0.05

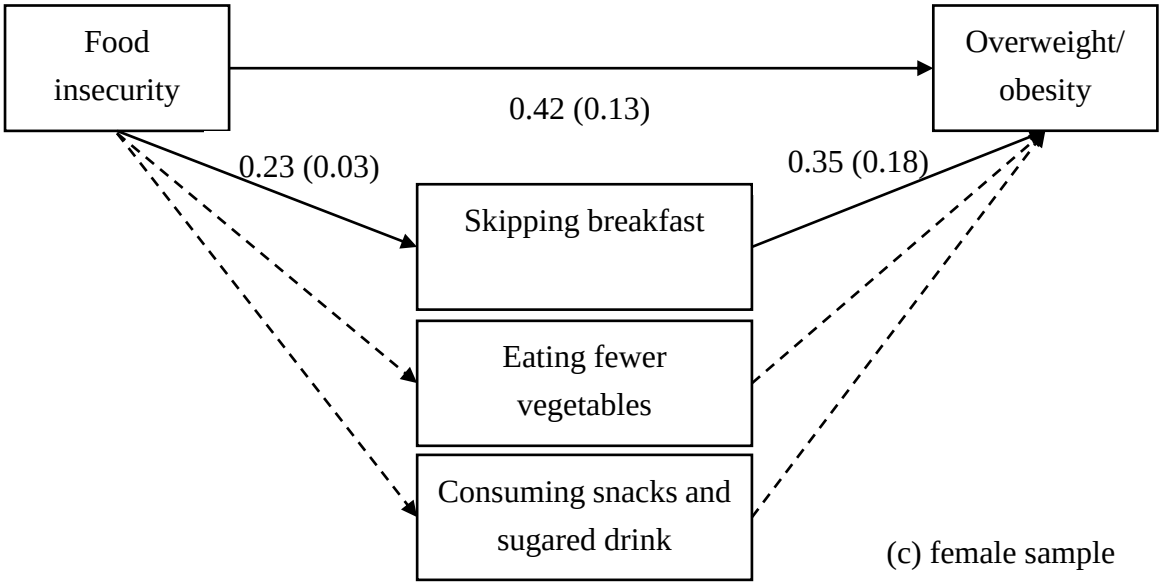
A total of 1000 random samples were generated in the bootstrap test with adjustment for family structure, household income, and pocket money status.



(a) entire sample



(b) male sample



(c) female sample

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附件二

科技部補助專題研究計畫成果自評表

請就研究內容與原計畫相符程度、達成預期目標情況、研究成果之學術或應用價值（簡要敘述成果所代表之意義、價值、影響或進一步發展之可能性）、是否適合在學術期刊發表或申請專利、主要發現（簡要敘述成果是否具有政策應用參考價值及具影響公共利益之重大發現）或其他有關價值等，作一綜合評估。

1. 請就研究內容與原計畫相符程度、達成預期目標情況作一綜合評估

■ 達成目標

□ 未達成目標（請說明，以 100 字為限）

□ 實驗失敗

□ 因故實驗中斷

□ 其他原因

說明：

2. 研究成果在學術期刊發表或申請專利等情形(請於其他欄註明專利及技轉之證號、合約、申請及洽談等詳細資訊)

論文：■已發表□未發表之文稿 □撰寫中 □無

專利：□已獲得□申請中 ■無

技轉：□已技轉□洽談中

■無

其他：(以 200 字為限)

3. 請依學術成就、技術創新、社會影響等方面，評估研究成果之學術或應用價值（簡要敘述成果所代表之意義、價值、影響或進一步發展之可能性，以 500 字為限）。

本研究在學術上發現經濟弱勢的青少年，糧食匱虞會導致體重過重或者肥胖的發生，其中部分原因是經由不健康的飲食行為，準此在介入體重控制的同時，應該考慮社會脈絡的架構，改善貧窮以及指導正確飲食方法，也許是針對這群易受感族群的體重控制良方。

4. 主要發現

本研究具有政策應用參考價值： □否 ■是，建議提供機關 社家署

(勾選「是」者，請列舉建議可提供施政參考之業務主管機關)

本研究具影響公共利益之重大發現：■否 □是

說明：(以 150 字為限)

研究發現糧食匱虞的現象在低收入家庭非常常見，而且糧食匱虞的情形與青少年肥胖有關，這樣的關係可能與飲食行為有關，因此結果建議政府應重視低收入家庭的糧食匱虞的問題，透過增進飲食行為識能，改善肥胖問題。

附件四

科技部補助專題研究計畫成果彙整表

計畫主持人：蔡孟哲	計畫編號：MOST 107－2629－B－006－001－
計畫名稱：台灣經濟弱勢家庭中兒童與青少年的體重狀態：糧食匱乏與飲食行為影響的性別差異	

成果項目					量化	單位	質化 （說明：各成果項目請附佐證資料或細項說明，如期刊名稱、年份、卷期、起訖頁數、證號...等）
國內	學術性論文	期刊論文				篇	請附期刊資訊。
		研討會論文					
		專書				本	請附專書資訊。
		專書論文				章	請附專書論文資訊。
		技術報告				篇	
		其他				篇	
	智慧財產權及成果	專利權	發明專利	申請中		件	請附佐證資料，如申請案號。
				已獲得			請附佐證資料，如獲證案號。
			新型/設計專利				
		商標權					
		營業秘密					
		積體電路電路布局權					
		著作權					
		品種權					
		其他					
	技術移轉	件數				件	
		收入				千元	1. 依「科技部科學技術研究發展成果歸屬及運用辦法」第 2 條規定，研發成果收入係指執行研究發展之單位因管理及運用研發成果所獲得之授權金、權利金、價金、股權或其他權益。 2. 請註明合約金額。
國外	學術性論文	期刊論文			1	篇	Appetite.2019;132:275-281.。
		研討會論文			1		PAS meeting, Toronto, Canada, 2018
		專書				本	請附專書資訊。
		專書論文				章	請附專書論文資訊。
		技術報告				篇	
		其他				篇	
	智慧財產權	專利權	發明專利	申請中		件	請附佐證資料，如申請案號。

	及成果			已獲得			請附佐證資料，如獲證案號。
			新型/設計專利				
		商標權					
		營業秘密					
		積體電路電路布局權					
		著作權					
		品種權					
		其他					
	技術移轉	件數				件	
		收入				千元	1. 依「科技部科學技術研究發展成果歸屬及運用辦法」第 2 條規定，研發成果收入係指執行研究發展之單位因管理及運用研發成果所獲得之授權金、權利金、價金、股權或其他權益。 2. 請註明合約金額。
參與計畫人力	本國籍	大專生			1	人次	請填寫依「科技部補助專題研究計畫約用研究人力注意事項」所實際約用專任、兼任人員。
		碩士生					
		博士生					
		專任人員(博士級)					
		專任人員(非博士級)					
	非本國籍	大專生			1		
		碩士生					
		博士生					
		專任人員(博士級)					
		專任人員(非博士級)					
其他成果 (無法以量化表達之成果如辦理學術活動、獲得獎項、重要國際合作、研究成果國際影響力及其他協助產業技術發展之具體效益事項等，請以文字敘述填列。)							

附件九

科技部補助研究計畫涉及臨床試驗之性別分析報告

日期：108 年 09 月 05 日

計畫編號	MOST 107－2629－B－006－001－		
研究人員姓名	蔡孟哲		
任職機關系所	國立成功大學醫學系小兒學科	職稱	助理教授
計畫名稱	台灣經濟弱勢家庭中兒童與青少年的體重狀態：糧食匱虞與飲食行為影響的性別差異		

說明：

本年度專題研究計畫涉及臨床試驗且進行性別分析，請於計畫成果報告(期中進度報告/期末報告)時一併繳交「性別分析報告」。

項次	項目	說明	備註
1	本計畫之研究結果已進行性別分析。	本研究結果特別進行不同性別分組的差異分析。	
2	本計畫之收案件數及其性別比例。	近1:1	
3	本計畫研究結果之性別差異說明。 如無性別差異，亦請說明。	發現男女在飲食行為上面有差異，而且糧食匱虞對體重造成的影響在女生群中更明顯。	

107年度專題研究計畫成果彙整表

計畫主持人：蔡孟哲	**計畫編號：**107-2629-B-006-001-
計畫名稱：台灣經濟弱勢家庭中兒童與青少年的體重狀態：糧食匱虞與飲食行為影響的性別差異	

成果項目					量化	單位	質化 （說明：各成果項目請附佐證資料或細項說明，如期刊名稱、年份、卷期、起訖頁數、證號...等）
國內	學術性論文	期刊論文			0	篇	
		研討會論文			0		
		專書			0	本	
		專書論文			0	章	
		技術報告			0	篇	
		其他			0	篇	
	智慧財產權及成果	專利權	發明專利	申請中	0	件	
				已獲得	0		
			新型/設計專利		0		
		商標權			0		
		營業秘密			0		
		積體電路電路布局權			0		
		著作權			0		
		品種權			0		
		其他			0		
	技術移轉	件數			0	件	
		收入			0	千元	
國外	學術性論文	期刊論文			1	篇	Appetite.2019;132:275-281.
		研討會論文			1		PAS meeting, Toronto, Canada, 2018
		專書			0	本	
		專書論文			0	章	
		技術報告			0	篇	
		其他			0	篇	
	智慧財產權及成果	專利權	發明專利	申請中	0	件	
				已獲得	0		
			新型/設計專利		0		
		商標權			0		
		營業秘密			0		
		積體電路電路布局權			0		
		著作權			0		
		品種權			0		
		其他			0		

	技術移轉	件數	0	件	
		收入	0	千元	
參與計畫人力	本國籍	大專生	1	人次	吳昶翰（成大醫學系學生）
		碩士生	0		
		博士生	0		
		博士級研究人員	0		
		專任人員	0		
	非本國籍	大專生	1		Camilla Meshki（哥本哈根大學醫學系暑期交換生）
		碩士生	0		
		博士生	0		
		博士級研究人員	0		
		專任人員	0		
其他成果 （無法以量化表達之成果如辦理學術活動、獲得獎項、重要國際合作、研究成果國際影響力及其他協助產業技術發展之具體效益事項等，請以文字敘述填列。）					

科技部補助專題研究計畫成果自評表

請就研究內容與原計畫相符程度、達成預期目標情況、研究成果之學術或應用價值（簡要敘述成果所代表之意義、價值、影響或進一步發展之可能性）、是否適合在學術期刊發表或申請專利、主要發現（簡要敘述成果是否具有政策應用參考價值及具影響公共利益之重大發現）或其他有關價值等，作一綜合評估。

1. 請就研究內容與原計畫相符程度、達成預期目標情況作一綜合評估
   ■達成目標
   □未達成目標（請說明，以100字為限）
   　□實驗失敗
   　□因故實驗中斷
   　□其他原因
   說明：

2. 研究成果在學術期刊發表或申請專利等情形（請於其他欄註明專利及技轉之證號、合約、申請及洽談等詳細資訊）
   論文：■已發表　□未發表之文稿　□撰寫中　□無
   專利：□已獲得　□申請中　■無
   技轉：□已技轉　□洽談中　■無
   其他：（以200字為限）

3. 請依學術成就、技術創新、社會影響等方面，評估研究成果之學術或應用價值（簡要敘述成果所代表之意義、價值、影響或進一步發展之可能性，以500字為限）
   本研究在學術上發現經濟弱勢的青少年，糧食匱虞會導致體重過重或者肥胖的發生，其中部分原因是經由不健康的飲食行為，準此在介入體重控制的同時，應該考慮社會脈絡的架構，改善貧窮以及指導正確飲食方法，也許是針對這群易受感族群的體重控制良方。

4. 主要發現
   本研究具有政策應用參考價值：□否　■是，建議提供機關衛生福利部,
   （勾選「是」者，請列舉建議可提供施政參考之業務主管機關）
   本研究具影響公共利益之重大發現：■否　□是
   說明：（以150字為限）
   研究發現糧食匱虞的現象在低收入家庭非常常見，而且糧食匱虞的情形與青少年肥胖有關，這樣的關係可能與飲食行為有關，因此結果建議政府應重視低收入家庭的糧食匱虞的問題，透過增進飲食行為識能，改善肥胖問題。