

Observing the Differences of Obesity Pattern and Food Choices between Supermarket and Public Market Consumers in Kandy District, Sri Lanka

C. P. Senevirathna¹, P. Katulanda², N. D. Dhanapala³, S. Jayawickrema⁴

^{1,2}Diabetes Research Unit, Faculty of Medicine, University of Colombo, Sri Lanka

³Regional Director Office of Health Services, Kandy District, Sri Lanka

⁴Faculty of Medicine, University of Colombo, Sri Lanka

Email address: ¹cpchamil@yahoo.com

Abstract—Food systems, both traditional and modern, are fundamentally connected to the health and subsistence of society. Furthermore, there are concerns that increase in per capita income, urbanization, and supermarket penetration in developing countries may contribute to an “obesogenic” diet transition, particularly increasing the consumption of energy-dense processed food at the expense of fresh fruits and vegetables and grains. Aim of this study was to observing the differences of obesity pattern and food choices between supermarket and public market consumers in Kandy District, Sri Lanka. Data were collected from individuals who do shop at supermarkets (n=214) and public market (n=124) during three hours of time. The goods packs of participants those who provided the consent, was assessed by using a check list. Weight and height measurements were taken using standard methods. SPSS 16 version was used to analyze the data. Mean age of supermarket and public market visitors were 45±13.9 years (CI=95%) and 49.5±13.8 years (CI=95%). 165 females (73.7%) were in the supermarket group whilst 84 females (67.7 %) were in the public market group. 77.2% supermarket visitors and 67.7% public market visitors were regular customers. Vegetable and fruit content of the supermarket users were 35.7% and 29% respectively, whereas 81.5% and 50.8% of public market users had vegetables and fruits in their good packs. Availability of carbohydrate rich foods in the supermarket and public market were 61.6% and 62.1% respectively. In terms of availability of processed meat products, supermarket and public market users were 40.6% and 17.7%. Mean BMI of the supermarket and public market group was 25.4 Kg^m⁻² (SD 4.07) and 24.1 Kg^m⁻² (SD 4.6) respectively. 30.9 % of the supermarket users were obese whilst 18.6 % of public market users were obese. Compared to the public market users, supermarket customers are more likely to hold more unhealthy food and lesser amount of vegetables and fruits in their goods pack

Keywords—Obesity; supermarket; public market; food choices.

I. INTRODUCTION

Overweight and obesity have been recognized as one of the major health problems in many countries [1]. The epidemic of overweight and obesity has become doubled since 1980s (2). According to the Global Health Observatory report (GHO) published by WHO nearly 2.8 million deaths occur each year caused by overweight and obesity [2]. In 2008 the prevalence of overweight and obesity in South East Asian Region (SEAR) were 14% and 3% respectively [2]. It is evident that the burden of overweight and obesity is prevalent in developing countries, and that it is shifting towards the low and middle income countries rapidly [3]. Obesity is also associated with increased risk for many chronic diseases including diabetes, hypertension, stroke, heart diseases and some cancers [4], [5]. Sedentary lifestyle, excessive intake of carbohydrate and fat rich foods are strongly associated with overweight and obesity [6-9]. The obesity in childhood is also known as a global challenge as obese and overweight children are likely to continue the condition into their adulthood and also more vulnerable to develop non-communicable diseases [10]. Increased use of high density energy foods and the sedentary lifestyle behavior are strongly associated with obesity and overweight in children [11-13].

Many studies have shown that there is a strong association between the obesity and the food environment which promote

high density energy foods [14]. It is evident that there is a link between the obesity and the dietary energy density and the energy cost [15]. Food choices of children and families are determined by the neighborhood food environment including food outlets where people do their shopping day to day life [16]. Supermarkets have included a high percentage of discretionary foods and promote unhealthy eating habits which contribute to the global obesity epidemic [17]. Special offers, discounts, promotions and other benefits are the strategies which can be seen in supermarkets to get customers attracted to their outlets [17]. Recent studies have suggested that the nutrition environments, including increasing the demand on convenience foods, supermarkets are widely believed to contribute the epidemic of obesity [18]. The terms of obesogenicity is defined as an environment which provides the opportunities or conditions on promoting obesity in individuals or populations [19]. Recent studies have identified a number of gaps and areas for improving that can explain some of the inconsistencies in the findings about the obesogenic environments [20].

In Sri Lanka, both traditional and modern shopping methods are being used by people. Arise of the supermarkets and the modern business strategies in the food marketing system have created a trend getting people attracted to it. The relationship between the obesity and the shopping methods has not been documented in Sri Lanka. This article documents the food choices and relationship between the obesity pattern

and the consumption of selected food categories among those who shop in supermarkets and public market in Kandy district Sri Lanka. This commentary will assist to determine the environmental factors which contribute to adaption of unhealthy food practices among frequent shoppers in both supermarkets and traditional markets in Sri Lanka.

II. METHODOLOGY

Data on this cross sectional descriptive study sample were selected from those who visit supermarket and public market in the city of Kandy, Sri Lanka. Survey was done on the 8th June in 2015 and those who provide verbal consent to participate the study were recruited. Five trained teams were deployed to gather information at four large supermarkets and one public market during three hours of time (9.30 am to 12.30 pm.).

Interviewer administered questionnaire was performed to collect demographic information including age, gender, occupation, frequency of visits. Information on nine items of food types (vegetable, fruits, fish, eggs, meats, processed meat, carbonic drinks, milk powder, etc.) which were available in the goods packs and also the number items from each food types were determined. Height and weight were gathered using standard protocol and BMI was calculated.

Collected data was coded and entered into Microsoft excel database and exported to SPSS version 16.0 for analysis. Descriptive statistics was performed to summarize the demographic information and anthropometric data and the results were presented using frequency tables and percentages. 95% confident level (CI) was used to determine the presence of association between explanatory variables amongst the respondents. Under weight, normal weight, overweight and obesity were described according to the WHO guideline for the Asian countries [35]. Pearson correlation was performed to determine the relationship of BMI and the food groups available in the good pack.

III. RESULTS

Social Demographic Characteristics

The demographic data of super marker users (n=224) and public market users (n=124) are shown in table I. Participants of this study were mostly females (73.3% super market users and 67.7% public market users). Mean age of the super market and public market shoppers were 45.8years (SD =13.9) and 49.5 years (SD =13.8) respectively. The highest percentages were obtained from age group 36-45 of super market group and age group 46-55 of public market users. Mean BMI of super market and public market users were 25.4 kgm⁻² (SD=4) and 24.1 kgm⁻² (SD = 4.6) respectively. 42.9% supermarket users were employed while 48.4% public market users were employed. Also 77.2% of respondents were regularly visit the supermarkets whereas 75.8% of respondents regularly visit the public market in order to buy their daily needs

BMI Characteristics among Public and Supermarket Users

According to the World Health Organization cut-off values of Asian, the percentages of public market users who were

underweight, normal weight, overweight and obesity were 7.3%, 44.4%, 29.9% and 18.6% respectively. Also the percentages of underweight, normal weight, overweight and obesity in supermarket users were 3.1%, 29.0%, 37.1% and 30.9% respectively (Table II).

Table I. social demographic characteristics of super market and public market users.

Characteristics	Super market users (n=224)		Public market users (n=124)	
	Mean	SD	Mean	SD
Age	45.8	13.9	49.5	13.8
BMI	25.4	4.0	24.1	4.6
	Number	%	Number	%
Gender				
Male	59	26.7	40	32.3
Female	165	73.3	84	67.7
Age groups				
<25	15	6.7	7	5.6
26-35	45	20.1	18	14.5
36-45	56	25	17	13.7
46-55	54	24.1	41	33.1
56-65	34	15.2	27	21.8
>65	20	8.9	14	11.3
Being employed				
Yes	96	42.9	60	48.4
No	127	56.7	64	51.6
Regular visitor				
Yes	173	77.2	94	75.8
No	51	22.8	30	24.2

Table II. BMI characteristics among public and supermarket users.

BMI group	Super market users (n=224)		Public market users (n=124)	
	Number	%	Number	%
Under weight	7	3.1	9	7.3
Normal weight	65	29.0	55	44.4
Overweight	83	37.1	37	29.9
Obese	69	30.9	22	18.6

Food Choices among Supermarket and Public Market Users

Table III shows the availability of selected food categories in the goods packs, among public and supermarket users. It was found that only 33.5 % supermarket users had bought vegetable while 81.5 % public market users had bought vegetable while shopping. Twenty nine percent of supermarket users had fruits in their goods pack while 51.6% of public market users had fruits in their goods packs. Availability of fish, meats and eggs among supermarket users were 11.6%, 20.1% and 9.8% respectively whereas availability of fish, meats and eggs in public market users were 44.4%, 19.4% and 27.4% respectively. Availability of carbonic drinks, sweets, processed meats and carbohydrate rich food in supermarket users were 25.4%, 55.8%, 40.6%, 61.6% respectively and availability of carbonic drinks, sweets, processed meats and carbohydrate rich foods in public market users were 12.9%, 32.3%, 17.7% and 62.1% respectively.

Table III. Availability of food categories among supermarket and public market users.

Food items	Supermarket users		Public market users	
	Availability		Availability	
	Yes (%)	No (%)	Yes (%)	No (%)
Vegetable	75 (33.5)	149 (66.5)	101 (81.5)	23 (18.5)
Fruits	65 (29)	159 (71)	64 (51.6)	60 (48.4)
Fresh Milk	22 (9.8)	202 (90.2)	6 (4.8)	118 (95.2)
Milk powder	92 (41.1)	132 (58.9)	28 (22.6)	96 (77.4)
Process foods	73 (32.6)	151 (67.4)	17 (13.7)	107 (86.3)
Fish	26 (11.6)	198 (88.4)	55 (44.4)	69 (55.6)
Eggs	22 (9.8)	202 (90.2)	34 (27.4)	90 (72.6)
Meat	45 (20.1)	175 (79.9)	24 (19.4)	100 (80.6)
Dry fish	17 (7.6)	207 (96.4)	28 (22.6)	96 (77.4)
Processed meat	91 (40.6)	132 (59.4)	22 (17.7)	102 (82.3)
Pulses	64 (28.6)	160 (71.4)	53 (42.8)	71 (57.2)
Sweets	125 (55.8)	99 (44.2)	40 (32.3)	84 (67.7)
Salt foods	108 (48.2)	116 (51.8)	25 (20.2)	99 (79.8)
Carbonic Drinks	57 (25.4)	167 (74.6)	16 (12.9)	108 (87.1)
Fruit Juice	16 (7.1)	208 (92.9)	5 (4)	119 (96)
Deep fried foods	75 (33.5)	149 (66.5)	52 (41.9)	72 (58.1)
Trans fat	54 (24.2)	170 (75.8)	18 (14.5)	106 (85.5)
Essence of taste	46 (20.5)	148 (79.5)	18 (14.5)	106 (85.5)
Carbohydrate foods	138 (61.6)	86 (38.4)	77 (62.1)	47 (37.9)

IV. INTRODUCTION

The phenomenon of “globalization” immensely influences the food system worldwide. Factors such as urbanization, growing income, competitive food industry, open market system and changes in lifestyle are strongly associated with the food transition in people in low and middle income countries. As a middle income country, people in Sri Lanka use both traditional and modern methods to fulfill their daily food requirement. Principal aim of this paper was to present the evidence on nutrition transition in terms of overweight and obesity as well as the transition of food choices in terms of consumption of specific food groups among supermarket and public market users in Kandy, Sri Lanka.

Overweight and obesity of participants were defined according to the World Health Organization cut-off value for Asians [35]. The study suggested that the risk of overweight and obesity were significantly high among the respondents. It was found that the risk of overweight and obesity among supermarket users was higher compared to the public market users. Researches done in Sri Lanka found that the prevalence of overweight and obesity were 25.2% and 9.2% respectively [21]. Similar results were obtained by another study done in Sri Lanka revealed that the prevalence of overweight and obesity were 28.7% (BMI 23.01-27.5) and 15.2% (BMI>27.5) respectively [22]. It was observed that the risk of overweight and obesity in both groups were greater than the national figures. In comparison with both groups, the risk of

overweight and obesity were found to be high in supermarket group. This observation depicts that various factors which are associated with being obese in people who use supermarkets to accomplish their daily needs. Few studies have examined the relationship between the food retail environment and the obesity in worldwide and confirmed that there was a strong relationship between the obesity and convenience stores and supermarkets [23-25]. Considering that matter, only limited studies have examined association of the food access and body weight; therefore future studies in this field are warranted. Cameron et al. 2014 revealed that there was a strong relationship between the size of the supermarkets and the prevalence of obesity in consumers [26]. World health organization has also revealed that the enormity of the food stall is strongly associated with the obesity [27]. Although the present study did not examine the underlying factors associated with the obesity and the sources where they do shopping in order to fulfill the daily requirement, many studies have shown that certain factors such as marketing strategies, offers, arrangement of various food items, convenience parking access, price reductions/discount encourage people to consume more unhealthy foods which influence on overweight and obesity [28], [29].

Table IV. Mean number of food items available in good packs among supermarket and public market users.

Food categories	Supermarket users (n=224)		Public market users (n=124)	
	Mean number of items in the good pack	SD	Mean number of items in the good pack	SD
Vegetable	0.98	1.68	3.53	2.36
Fruits	0.50	0.87	0.78	0.96
Fresh Milk	0.15	0.49	0.08	0.35
Milk powder	0.66	0.98	0.27	0.54
Process foods	0.6	1.07	0.18	0.56
Fish	0.15	0.44	0.59	0.77
Eggs	0.66	2.14	1.26	2.31
Meat	0.32	0.78	0.25	0.58
Dry fish	0.11	0.42	0.35	0.73
Processed meat	0.89	1.22	0.24	0.61
Pulses	0.43	0.78	0.82	1.11
Sweets	1.54	1.69	0.57	0.96
Salt foods	1.00	1.36	0.27	0.58
Carbonic Drinks	0.38	0.74	0.12	0.33
Fruit Juice	0.08	0.32	0.04	0.25
Deep fried foods	0.57	0.94	0.50	0.65
Trans fat	0.40	0.93	0.17	0.43
Essence of taste	0.45	1.36	0.30	0.83
Carbohydrate foods	1.46	1.42	0.90	0.87

However there have been handful researches to demonstrate the relationship between the nutritional status and the use of public markets where low-income community people shop to fulfill their daily needs. Few studies done in the international context with the objective of determining the consumption of fruits and vegetable among those who attend the public markets, found that public market users consume vegetable with more frequent than those who do not shop at public market [30], [31]. Furthermore study revealed inconvenience, price, being uninterested, not conducive for children were that factors to discourage clients who did not attend the public market [32]. Similarly the present study

found that there was a significant different between the two groups in terms of consuming vegetable and fruits (Table III).

Studies have confirmed that those who shopped at the public market/farmers market consume five or more fruits and vegetable (42.1%) than the supermarket users [33]. Confirming the above findings, the present study observed that the availability of varieties of vegetable, fruits, fish, eggs, dry fish, were greater among the supermarket users compared to the public market shoppers. Also the varieties of processed foods, milk powder, processed meat, sweets, carbonic drinks, deep fried foods were common in supermarket group (Table IV)

Table V. Correlation between age, BMI and number of selected food items available in the goods pack

Food categories	Supermarket users (n=224)				Public market users (n=124)			
	Age	P value	BMI	P value	Age	P value	BMI	P value
Vegetable	0.071	>0.050	0.107	>0.05	-0.165	>0.050	0.136	<0.05
Fruits	-0.098	>0.050	0.005	>0.05	-0.134	>0.050	0.122	<0.05
Fresh Milk	0.014	>0.050	0.042	>0.05	0.025	>0.050	-0.172	<0.05
Milk powder	0.062	>0.050	-0.144	<0.05	-0.064	>0.050	0.131	<0.05
Process foods	0.084	>0.050	-0.064	<0.05	-0.011	>0.050	0.084	>0.05
Fish	-0.021	>0.050	-0.013	<0.05	-0.060	>0.050	0.152	<0.05
Eggs	0.154	<0.000	0.022	>0.05	-0.042	>0.050	0.135	<0.05
Meat	-0.028	>0.050	0.120	<0.05	-0.133	>0.050	-0.028	>0.05
Dry fish	0.007	>0.050	0.154	<0.05	0.185	<0.050	0.164	<0.05
Processed meat	-0.035	>0.050	0.141	<0.05	-0.071	>0.050	-0.054	<0.05
Pulses	-0.030	>0.050	-0.064	<0.05	0.141	<0.050	0.135	<0.05
Sweets	0.042	>0.050	0.154	<0.05	0.039	>0.050	0.049	>0.05
Salt foods	-0.088	>0.050	0.118	<0.05	-0.221	<0.050	0.121	<0.05
Carbonic Drinks	0.088	>0.050	0.169	<0.05	0.011	>0.050	-0.057	>0.05
Fruit Juice	-0.119	>0.050	0.167	<0.05	-0.102	>0.050	-0.088	>0.05
Deep fried foods	0.051	>0.050	0.119	<0.05	0.074	>0.050	0.011	>0.05
Trans fat	0.058	>0.050	0.111	<0.05	-0.119	>0.050	0.025	>0.05
Essence of taste	0.001	>0.050	0.196	<0.05	-0.071	>0.050	0.241	<0.05
Carbohydrate foods	-0.08	>0.050	0.189	<0.05	0.071	>0.050	0.181	<0.05

Even though many studies have shown that there was a strong relationship between obesity and the food environment [34], the association between various food categories and the BMI status has not been defined well. Filling that evidence gap, present study demonstrated that there was a significant correlation between the selected food groups with the BMI and the age. Age of the supermarket and public market users was positively correlated with the availability of certain food groups (Table V). Although there was a positive correlation between availability of vegetable, fruits and fresh milk, which was not significant, significant relationship was seen between the availability of meat, dry fish and processed meat among supermarket users. BMI of the public market users was significantly correlated with availability of vegetable, fruits, milk powder, fish, meat, pulses, etc. (Table V). However, the recent studies in this filed confirmed the relationship between the retail food environment and obesity. Present study observed the relationship between the BMI and the food choice based on the availability of certain food types in the good packs. Further longitudinal and experimental research is needed to determine the relationship between awareness of food categories and the obesity.

V. LIMITATIONS OF THE STUDY

Present study has few limitations which can be addressed in future studies. Primarily this study cannot be generalized to the whole community as this was done aiming selected population groups in the district of Kandy. Secondly the sample size of the study was small which should be increased in order to understand most important factors associated with food choices at a more generalized level. Thirdly, the selected sample wasn't scientifically calculated. Therefore future studies should select a calculated sample to improve the scientific validity of the study. And also this study did not focus on detailed dietary pattern of the participants. Future studies should be encouraged to focus on assessing the dietary pattern which ensures the scientific validity of the study. Another limitation of the study was, types of the supermarkets not been defined well. Size, parking facilities, location can be known as supportive factors to get customers attracted on their outlets. Therefore definition on the supermarket should be included in future studies. Since the time was a limiting factor to collect all the information present study did not focus on other lifestyle factors such as level of the physical activities in terms of all the domains including transport, leisure, work and

house hold work. Although the presence of vegetables and fruits was less among supermarket users, they might buy them from outside market. Therefore a tool should be developed to collect all these information which would be useful to interpret all the underlying factors.

VI. CONCLUSION

In conclusion, findings of the present study suggest that the risk of overweight and obesity among those who visit supermarkets was greater than the public market users. Also the availability of fruits and vegetables in goods packs of supermarket users was found to be less compared to the public market users. Also there was a significant correlation between the BMI and the availability of selected food types in both groups. This paper does not emphasize that the use of supermarket should be limited as consumers more likely to select unhealthy foods while they do the shopping. On the other hand public market users are more likely to consume more vegetable and fruits which are affordable for low or middle-income community people, and also they consume less unhealthy food as they intend to cut down unwanted expenses. Nowadays the concept of supermarket is very common among general public and it is convenient. Supermarket is a place where all types of foods can be available under one roof. Interventions should be developed in order to encourage consumers to develop awareness on filling their goods pack with healthy goods and cutting down on the unhealthy selections.

ACKNOWLEDGMENT

Chamil Senevirathna is supported by the Fogarty International Centre, National Institutes of Health, under Award Number: D43TW008332 (ASCEND Research Network). The contents of this publication is solely the responsibility of the author(s) and does not necessarily represent the official views of the National Institutes of Health or the ASCEND Research Network.

REFERENCES

- [1] H. Xuhong, J. Weiping, B. Yuqian, L. Huijuan, J. Shan, Z. Yuhua, G. Huilin, and X. Kunsan, "Risk factors for overweight and obesity, and changes in body mass index of Chinese adults in Shanghai," *BMC Public Health*, 8:389, pp. 1-9, 2008.
- [2] Report on Obesity and Overweight, World Health Organization. <http://www.who.int/mediacentre/factsheets/fs311/en/>, 2014.
- [3] Global Health Observatory (GHO) data, World Health Organization, http://www.who.int/gho/ncd/risk_factors/obesity_text/en/, 2014.
- [4] B. M. Popkin and P. Larsen, "The nutrition transition: worldwide obesity dynamics and their determinants", *International Journal of Obesity*, 2004, vol. 28, S2-S9.
- [5] M. Dang, M. D. Nguyen, B. Hashem, and E. Serag, "The epidemiology of obesity," *NIH Public Access*, vol. 39, no. 1, pp. 1-7, 2010.
- [6] O. T. Trinh, N. D. Nguyen, P. Phongsavan, M. J. Dibley, and A. E. Bauman, "Prevalence and risk factors with overweight and obesity among Vietnamese adults: Caucasian and Asian cut-offs," *Asia Pacific Journal of Clinical Nutrition*, vol. 18 (2), pp. 226-33, 2009.
- [7] A. R. Gbary, A. Kpozehouen, Y. C. Houehanou, F. Djrolo, M. P.G. Amoussou, T. Yessouf, S. Roger, and D. S. Houinato, "Prevalence and risk factors of overweight and obesity: Findings from a cross-sectional community-based survey in Benin," *Global epidemic Obesity*, 2010.
- [8] A. H. Mokdad, E. S. Ford, B. A. Bowman, W. H. Dietz, F. Vinicor, V. S. Bales, and J. S. Marks, "Prevalence of obesity, diabetes, and obesity-related health risk factors 2001," *Journal of the American Medical Association*, vol. 289(1), pp. 76-79, 2003.
- [9] A. S. Barnes, "Obesity and Sedentary Lifestyles Risk for Cardiovascular Disease in Women," *Texas Heart Institute Journal*, vol. 39(2), pp. 224-227, 2012.
- [10] Childhood Overweight and Obesity, Global Strategy on Diet, Physical Activity and Health, World health organization, 2014 <http://www.who.int/dietphysicalactivity/childhood/en/>
- [11] I. Janssen, P. T. Katzmarzyk, W. F. Boyce, C. Vereecken, C. Mulvihill, C. Roberts, C. Currie, and W. Pickett, "Comparison of overweight and obesity prevalence in school-aged youth from 34 countries and their relationships with physical activity and dietary patterns," vol. 6, pp. 123-132, 2005.
- [12] C. B. Ebbeling, D. B. Pawlak, and D. S. Ludwig, "Childhood obesity: public-health crisis, common sense cure," *Lancet*, vol. 360(9331), pp. 473-82, 2002.
- [13] L. L. Birch and J. O. Fisher, "Development of eating behaviors among children and adolescents," *Pediatrics*, vol. 101, issue supplement 2, 1998.
- [14] A. Michimi and M. C. Wimberly, "Associations of supermarket accessibility with obesity and fruit and vegetable consumption in the conterminous United States," *International Journal of Health and Geographic*, 9:49, pp. 1-14, 2010.
- [15] E. C. Caitlin, K. Ichiro, S. V. Subramanian, A. Gary, and S. Glorian, "The relationship between diet and perceived and objective access to supermarkets among low-income housing residents," *NIH Public Access*, vol. 75(7), pp. 1254-1262, 2012.
- [16] L. Mikkelsen and S. Chehimi, *The Links Between the Neighborhood Food Environment and Childhood Nutrition*, Prevention Institute Oakland, Calif, Robert Wood Johnson Foundation, 2007.
- [17] E. L. Charlton, L. A. Kahkonen, G. Sacks, and A. J. Cameron, "Supermarkets and unhealthy food marketing: An international comparison of the content of supermarket catalogues/circulars," *Journal of Preventive Medicine*, vol. 81, pp.168-173, 2015.
- [18] J. F. Sallis and K. Glanz, "The role of built environments in physical activities, eating and obesity in childhood," *The Future of Children*, vol. 16(1), pp. 89-108, 2006.
- [19] J. D Mackenbach, H. Rutter, S. Compornolle, K. Glonti, J. M. Oppert, H. Charreire, I. De Bourdeaudhuij, J. Brug, G. Nijpels, and J. Lakerveld, "Obesogenic environments: a systematic review of the association between the physical environment and adult weight status, the SPOTLIGHT project," *BMC Public Health*, vol. 14:233, pp. 1-15, 2014.
- [20] A. Lake and T. Townshend, "Obesogenic environments: exploring the built and food environment," *The Journal of the Royal Society for the Promotion of Health*, vol. 126, no. 6, pp. 262-267, 2006.
- [21] P. Katulanda, M. A. Jayawardena, M. H. Sheriff, G. R. Constantine, and D. R. Mathews, "Prevalence of overweight and obesity in Sri Lankan adults," *Journal of the International Association for the Studies of Obesity*, vol. 11(11), pp. 751-756, 2010.
- [22] R. Jayathissa, S. M. Moazzem, S. Gunewardena, J. M. Ranbanda, M. Gunathilake, and P. C. De Silva, "Prevalence and associations of overweight among adult women in Sri Lanka: a national survey," *Sri Lanka Journal of Diabetes, Endocrinology and Metabolism*, vol. 2, no. 2, pp. 61-68, 2012.
- [23] J. N. Bodor, J. C. Rice, T. A. Farley, C. M. Swalm, and D. Rose, "The association between obesity and urban food environments," *Journal of Urban Health*, 87(5), pp. 771-781, 2010.
- [24] M. Ahern, C. Brown, and S. Dukas, "A national study of the association between food environments and county-level health outcomes," *JR Health*, vol. 27(4), pp. 367-79, 2011.
- [25] J. E. Holsten, "Obesity and the community food environment: a systematic review," *Public Health Nutrition*, vol. 27(4), pp. 367-79, 2009.
- [26] A. J. Cameron, W. E. Waterlander, and C. M. Svastisalee, "The correlation between supermarket size and national obesity prevalence," *BMC Obesity*, 1:27, 2014.
- [27] New world health organization study links obesity to supermarket size, WHO, 2014.
- [28] S. Cummins and S. Macintyr, "Food environments and obesity neighborhood or nation," *International Journal of Epidemiology*, vol. 35, pp. 100-104, 2006.
- [29] E. L. Charlton, L. A. Kahkonen, G. Sacks, and A. J. Cameron, "Supermarkets and unhealthy food marketing: An international

- comparison of the content of supermarket catalogues/circulars,” *Journal of Preventive Medicine*, vol. 81, pp. 168-173, 2015.
- [30] O. Jennifer and P. Porter, “Farmers markets: impact on fruit and vegetable consumption of supplemental nutrition assistance program clients,” *The Boston Collaborative for Food and Fitness*, 2014.
- [31] M. Karakus, R. Milfort, K. MacAllum, and H. Hongsheng, “Nutrition assistance in farmers markets: understanding the shopping patterns of SNAP participants,” *United State Department of Agriculture*, 2014.
- [32] S. B J. Pitts, W. Qiang, J. T McGuirt, T. W Crawford, T. C Keyserling, and A. S Ammerman, “Associations between access to farmers’ markets and supermarkets, shopping patterns, fruit and vegetable consumption and health indicators among women of reproductive age in eastern North Carolina USA,” *Public Health Nutrition*, vol. 16(11), pp. 1944-1952, 2013.
- [33] A. J Cameron, W. E Waterlander, and C. M. Svastisalee, “The correlation between supermarket size and national obesity prevalence,” *BMC Obesity*, 1:27, pp. 1-4, 2014.
- [34] J. N. Bodor, J. C. Rice, T. A. Farley, C. M. Swalm, and D. Rose, “The association between obesity and urban food environments,” *Journal of Urban Health, Bulletin of the New York Academy of Medicine*, vol. 87, issue 5, pp. 771-781, 2010.
- [35] BMI Classification, World Health Organization.
http://apps.who.int/bmi/index.jsp?introPage=intro_3.html