# **Original Research Article**

DOI: http://dx.doi.org/10.18203/2394-6040.ijcmph20174213

# Patterns of eating associated with the chronic diseases in Al-Ahsa, Saudi Arabia

Hassan Ali Al Sayegh<sup>1</sup>\*, Abdulaziz Adel Al Qurini<sup>1</sup>, Abdul Sattar Khan<sup>2</sup>, Sayed Ibrahim<sup>2</sup>

<sup>1</sup>College of Medicine, Al-Ahsa, Eastern province, Saudi Arabia

Received: 22 July 2017 Accepted: 19 August 2017

#### \*Correspondence:

Dr. Hassan Ali Al Sayegh, E-mail: Has.m20@hotmail.com

**Copyright:** © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

#### **ABSTRACT**

**Background:** There is increase in the limitation of daily activity of people with chronic diseases. This may be due to multiple factors one of them is the nature of the lifestyle for instance, patterns of eating that the person is following. It is important to sum the dietary behaviors in specific population to see how much is it associated with chronic diseases. Specially, obesity, cardiovascular diseases, diabetes and sickle cell disease which are endemic diseases in Al-Ahsa. Moreover, no studies have been conducted in this area before. It is known that there is increased obesity, cardiovascular and diabetes prevalence in Al-Ahsa. The study aims to see the association between chronic diseases and eating patterns.

**Methods:** Cross sectional study, self-reported questionnaire distributed to the population under supervision of the data collectors in Al-Ahsa, during the summer of 2017.

**Results:** The most prevalent chronic disease is obesity. Then comes hypertension and G6PD. Obesity showed most association with other chronic diseases. Also, eating frozen canned food show associations with obesity, hypertension, G6PD and diabetes.

**Conclusions:** We concluded that there are certain eating behaviors influences some chronic diseases; there should be a focus on these behaviors to prevent the occurrence of these chronic diseases, especially metabolic diseases. Obesity is the primary concern which may facilitate the developing of hypertension, asthma, diabetes, high cholesterol, G6PD, hypothyroidism, hyperthyroidism, diabetes, sickle cell disease and cardiovascular events.

Keywords: Chronic diseases, Diabetes, Obesity, Eating patterns, Hypertension

## **INTRODUCTION**

One or more daily activity is limited in those people with chronic diseases, this consists of about one-fourth of them. Health differences in chronic disease mortality and incidence are widespread among members of ethnic and racial minority population e.g., African Americans have heart disease death rates higher than whites. American Indians and Alaska have higher diabetes rates than whites. The rates of adults with elevated cholesterol, a

noteworthy hazard consider for coronary illnesses, has been cut considerably since the mid-1960s.<sup>3</sup> The first and third leading causes of death are heart diseases and stroke, responsible for more than 30% of all mortality.<sup>2</sup> The leading cause of kidney failure, non-traumatic lower-extremity amputations, and blindness among adults aged 20–74 is diabetes.<sup>4</sup> Obesity (BMI≥95th percentile of the CDC growth chart) is almost 1 in 5 youth between the ages of 6 and 19.<sup>5</sup> The risk factors for heart disease is 61% of obese children aged 5–10 years, and 27% have two or more.<sup>6</sup> A total of 19 million American adults

<sup>&</sup>lt;sup>2</sup>Department of Family & Community Medicine, College of Medicine, Al-Ahsa, Eastern province, Saudi Arabia

report being limited in their usual activities because of arthritis.' The situation in Kingdom of Saudi Arabia (KSA) related to above mentioned diseases not much different from the world. KSA gone through an enormous financial improvement in the previous five decades with fast urbanization and changes in the populace ways of life and International Diabetes Federation grouped KSA to be among the main 10 nations all around with the most elevated commonness of diabetes in 2011 (16.2%) and 2030 (20.8%). Hypertension is expanding in prevalence in KSA influencing more than one fourth of the grown-up Saudi population the prevalence of hypertension was 26.1% in crude terms. The prevalence of hypertension in males is 28.6%, while for females, the prevalence was significantly lower at 23.9% (p<0.001). Prevalence of the full metabolic syndromes among urban Saudi grownups stays high, however has impressively diminished. Prevalence of low-HDL cholesterol then again remains to a high level predominant and asks for harder measures in early intervention and further logical investigation. <sup>10</sup> An overall obesity prevalence of 35.5% in KSA. Obesity and overweight are increasing.<sup>11</sup> Other study concludes the overall prevalence of coronary artery diseases in KSA is 5.5%. 12 In a study concluded that a thyroid dysfunction is 45% in prevalence among diabetic Saudis. 13 Sickle cell disease prevalence in), western region (12 cases/10,000 population), and central region (6 cases/10,000 population). And in eastern province of KSA is 145 cases/10,000 populations, which is much higher than the prevalence in the southern region (24 cases/10,000 population).<sup>14</sup> In the Kingdom, late reviews uncovered expanding consumptions of animal items and distinguished nourishment in the eating regimen to the detriment of vegetables and organic products. 15,16 These dietary habits changes were blamed for expanding the commonness for both obesity and overweight seen among Saudi children. Food decisions inclined toward the higher Energy food. 17 There are four causes play the greater part developing chronic diseases, principally absence of physical exercise, poor nourishment, tobacco utilization, and excessive alcohol intake. Chronic diseases can be prevented by following certain dietary habits. These chronic diseases including some cancers, heart disease, stroke, diabetes, and osteoporosis. Fruits and vegetables consumption reduces the risk for heart disease and certain cancers as well. Weight managing will balance the number of calories consumed with the number of calories the body burns off.<sup>18</sup> Keeping in view of the importance of the diet pattern in developing chronic diseases, we designed this study to assess whether the patterns of eating have any association on the chronic diseases is the main issue in this study. This aimed to investigate the differences in the patterns of eating among Al-Ahsa population in relation to chronic diseases such as diabetes, hypertension, obesity.

# **METHODS**

A cross-sectional study was conducted in Al-Ahsa, KSA during the summer of 2017. A total number of 181

females and 228 males from different age groups had participated in the study from Al-Ahsa. The research has been approved by the committee of Research and Ethics in College of Medicine, King Faisal University. Selfreported questionnaire was administered demographical data was collected. The questionnaire was designed to study drinking, eating habits for the population, and its association to the chronic diseases. The pilot study conducted to assess the validity and reliability of the questionnaire. The questionnaire has to assess dieting behaviours, auestions preoccupation, and bulimic behaviours. For each item, participants have asked how often, on average, they consumed this amount during the last year. Inclusion of all age groups from both genders randomly. Excluded from the sampling frame were individuals with severe cognitive impairment (e.g., mental retardation).

Data collection included demographics such as age, gender, region, monthly income, educational level, body mass index (BMI) and current health status. Different questions assess the patterns of eating. The BMI provides a standard for assessing overall dietary quality, eating habits and its relation to the different family situations. Based on the most current scientific information available. 19 The Index correlates well with other conventional measures of diet quality. Depending on the score, we can conclude the nutritional behaviour in this population. SPSS version 20 was used to enter the patient information and checking whether the data is corrected or not. After cleaning the data, we performed descriptive and inferential analysis. Chi-square test was applied for assessing the association within the categorical variables. P value is 0.05 as standard for assessing the association among variables. Finally, representing the data with graphs and tables.

## **RESULTS**

Four hundred and nine responders were enrolled in this study, 181 females and 228 males. Many responders are aged from 16 years old to 34 years old. Furthermore, 179 responders have normal body mass index, 114 are obese and 116 are highly obese in Table 1. The main chronic disease which most of the responders have is obesity with 60.30% out of 100%. Hypertension is the second common chronic disease in this study with 34.17% out of 100%. Then, G6PD is the third with 28.14%, and the fourth is diabetes with 26.13% in Figure 1. In the questions regarding the eating pattern, the fifth question approved 46.9% are sometimes cooking frozen packaged canned ingredients. In contrast, 3.4% almost always cook frozen packaged canned ingredients in Table 2. Furthermore, 32.2% sometimes eat light or low-fat products and 8.8% almost always do it in Table 2. Table 3 there was a significance association between age and asthma with (p=0.001), age and hypertension with (p=0.000) and age and obesity with (p=0.021). Similarly, obesity, G6PD, diabetes, cardiovascular disease and asthma demonstrated a significant association with (p=0.000). Moreover, eating patterns which related to chronic diseases in Table 4 that hypertension, G6PD, diabetes with the people who consume frozen packaged canned food have which reveal a significant association too (p=0.000). Obesity showed association with consumption of frozen packaged canned food with

(p=0.038). Carbonated drinks showed association with cardiovascular disease (p=0.038) and high cholesterol (p=0.017). Hypothyroid patients revealed that they skip lunch in the Table 4 with (p=0.16).

Table 1: Demographic data (n=409).

Variable	Groups	Frequency	Percentage (%)
	16 - 24	178	43.5
	25 - 34	116	28.4
	35 - 44	51	12.5
Age in years	45 - 54	45	11.0
	55-64	9	2.2
	Less than 15	2	0.5
	More than 65	8	1.9
	Female	181	44.3
Gender	Male	228	55.7
	Total	409	100.0
	Hufof	174	42.5
Region	Mubarraz	113	27.6
	villages	122	29.8
	High school degree	82	20.0
Educational level	Primary school degree	8	2.0
Educational level	Secondary school degree	13	3.2
	University degree	306	74.8
	4000-10000 SR	111	27.1
Monthly income	Less than 4000 SR	210	51.3
	More than 10000 SR	88	21.5
	Normal	179	43.77
Body mass index (BMI)	Obesity	114	27.87
	High Obesity	116	28.36

Table 2: Responses of the questions regarding pattern of eating (n=409).

S. no.	Questions	Almost always (%)	Never (%)	Often (%)	Seldom (%)	Sometimes (%)
1	Do you eat when you are not hungry?	19 (4.6)	32 (7.8)	51 (12.5)	94 (23.0)	213 (52.1)
2	Do you find yourself thinking about eating?	17 (4.2)	36 (8.8)	65 (15.9)	118 (28.9)	173 (42.3)
3	Are meals in your family made almost solely from fresh ingredients?	127 (31.1)	2 (0.5)	192 (46.9)	14 (3.4)	74 (18.1)
4	Does do the cooks in your family use fresh herbs and or spices?	153 (37.4)	6 (1.5)	145 (35.5)	18 (4.4)	87 (21.3)
5	Does do the cooks in your family use frozen packaged canned ingredients?	14 (3.4)	15 (3.7)	87 (21.3)	101 (24.7)	192 (46.9)
6	Do you eat in fast foods e.g. McDonald's	16 (3.9)	110 (26.9)	39 (9.5)	130 (31.8)	114 (27.9)
7	Do you drink carbonated beverages such as popor sparkling juice drinks?	48 (11.7)	72 (17.6)	50 (12.2)	141 (34.5)	98 (24)
8	Do you drink "real" fresh juices not artificially flavored?	38 (9.3)	4 (1)	104 (25.4)	79 (19.3)	184 (45)
9	Do you eat other "light" or "low fat" products?	36 (8.8)	32 (7.8)	90 (22)	119 (29.1)	132 (32.2)
10	Do you eat "light" meals (e.g., Weight Watchers meals) for breakfast, lunch or dinner?	13 (3.2)	51 (12.5)	56 (13.7)	134 (32.8)	155 (37.9)
11	Do you skip breakfast?	37 (9)	87 (21.3)	90 (22)	92 (22.5)	103 (25.2)
12	Do you skip lunch?	6 (1.5)	121 (29.6)	39 (9.5)	115 (28.1)	128 (31.3)
13	Do you skip supper?	17 (4.2)	110 (26.9)	48 (11.7)	118 (28.9)	116 (28.4)

14	Do you eat little bits of food throughout the day, snacking whenever you feel like it instead of sitting down for 3 separate meals?	37 (9)	12 (2.9)	110 (26.9)	86 (21)	164 (40.1)
15	Do you have a fourth small meal, or snack, (i.e. after-school snack) in addition to breakfast, lunch, and supper?	33 (8.1)	49 (12)	56 (13.7)	129 (31.5)	142 (34.7)
16	Are family sit-down meals replaced by "food on the run" or quicker Meals (i.e. TV dinner)?	29 (7.1)	123 (30.1)	56 (13.7)	115 (28.1)	86 (21)
17	Do you eat regular meals with your immediate family at home sitting at the tab?	24 (5.9)	103 (25.2)	64 (15.6)	22 (5.4)	196 (47.9)

Table 3: Association among chronic diseases (n=409).

Association among chronic diseases	Frequency (%)	P value
Age and asthma	16 (3.9)	0.001
Age and hypertension	34 (8.3)	0.000
Age and G6PD	28 (6.8)	0.000
Age and obesity	60 (14.7)	0.021
Age and hypothyroidism	3 (0.7)	0.000
Age and hyperthyroidism	4 (1)	0.000
Age and diabetes	26 (6.4)	0.000
Age and cardiovascular disease	6 (1.5)	0.018
Age and sickle cell disease	13 (3.2)	0.000
Gender and hypertension	34 (8.3)	0.029
Gender and G6PD	28 (6.8)	0.004
Gender and obesity	60 (14.7)	0.034
Gender and diabetes	26 (6.4)	0.008
Obesity and asthma	16 (3.9)	0.000
Obesity and hypertension	34 (8.3)	0.000
Obesity and G6PD	28 (6.8)	0.000
Obesity and hypothyroidism	3 (0.7)	0.000
Obesity and hyperthyroidisms	4 (1)	0.000
Obesity and diabetes	26 (6.4)	0.000
Obesity and cardiovascular diseases	6 (1.5)	0.000
Obesity and high cholesterol	9 (2.2)	0.000
Obesity and sickle cell disease	13 (3.2)	0.000

Table 4: Association among chronic diseases and diet pattern (n=409).

Questions and chronic diseases	Frequency (%)	P value
Does do the cooks in your family use frozen packaged canned ingredients when eating and hypertension?	34 (8.3)	0.000
Does do the cooks in your family use frozen packaged canned ingredients when eating and G6PD?	28 (6.8)	0.000
Does do the cooks in your family use frozen packaged canned ingredients when eating and obesity?	60 (14.7)	0.038
Does do the cooks in your family use frozen packaged canned ingredients when eating and diabetes?	26 (6.4)	0.000
Do you drink carbonated beverages such as popor sparkling juice drinks and Cardiovascular disease?	6 (1.5)	0.038
Do you drink carbonated beverages such as popor sparkling juice drinks and high cholesterol?	9 (2.2)	0.017
Do you skip lunch and hypothyroidism?	3 (0.7)	0.016

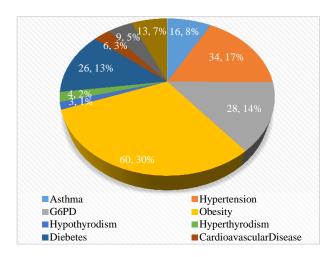


Figure 1: Distribution of the chronic diseases (n=409).

#### **DISCUSSION**

The purpose of this study was to assess eating patterns in different social classes, regions, and identify whether there are any associations with the common different chronic diseases among Al-Ahsa population. Correlation of their body weight status and composition with their eating patterns. The current data demonstrated that more than half of the population were above the normal body weight. Obesity among the population represented 60.3% of the sample. Other chronic diseases represent a high number are G6PD, hypertension and diabetes. This influenced as described in other study, metabolic diseases risks increasing could be related to lower consumption of fruits and vegetables, higher consumption of foods rich in fat, carbohydrates and salt.<sup>20</sup> Which is already approved in this study. Prevalence of diabetes in Saudi Arabia was about quarter of the population being unaware of their disease.<sup>21</sup> Metabolic diseases, such as increasing the risk of elevated blood sugar level, elevated blood pressure, dyslipidemia, and obesity have a genetic determinant can be driven by variants that contribute to a higher risk of developing traits, but it was not approved in this study.<sup>20</sup> Such a questionnaire is important to identify between one time to another how the disease is evolving. On the other hand, there was a significance relationship between age and most of chronic diseases. For instance, there is a significance relationship between age and asthma which is recently increased in prevalence in Saudi Arabia, specially Al-Ahsa.<sup>22</sup>

In a study assessing the cardiovascular factors in Saudi patients, there was about 50% have modifiable risk factors, such hypertension, diabetes, obesity which support the data of significance in this study. <sup>23</sup> In contrast, in Italy, the largest cause of mortality in women are cardiovascular diseases but not in men and this difference has increased in recent years. <sup>22</sup> Thus risk factors are more likely to occur in women. This study also influences the relationships between hypertension, G6PD, obesity and diabetes. Now the core of the study to see what eating patterns influences the chronic disease

status. The data demonstrated a relationship between obese patient and thinking of the food most of the time. Also, high co morbidity between poor mental health and obesity and this may reflect some shared underlying mechanisms and common potentially modifiable risk factors in the recent researches.<sup>24,25</sup> Also, using a frozen/canned food has a relationship with hypertension, G6PD, obesity and diabetes. And these were expected to have a relationship except for G6PD. So, it may be a relationship between G6PD patients and different eating patterns. Drinking carbonated beverages have already been associated with weight gain in all age groups, as result most of the risk factor like cardiovascular events and high cholesterol can occur. 26 A relationship with cardiovascular diseases and high cholesterol levels. So, these patients are more vulnerable to progress consuming these beverages. Hypothyroid patients mostly skip lunch. Last part is to compare obesity with the other chronic diseases. It is found that Obesity has relationship with most of chronic diseases, asthma, hypertension, G6PD, hypothyroidism, hyperthyroidism, diabetes, cardiovascular diseases, high cholesterol and sickle cell disease. Worldwide more than half a billion adults are now obese (BMI≥30 kg/m<sup>2</sup>), and the prevalence of obesity has increased epidemically during the past 4 decades.<sup>27</sup> Also, there is an increased risk of diseases including type 2 diabetes, cardiovascular diseases. 28,29

#### **CONCLUSION**

We concluded that there is a certain eating behavior influences some chronic diseases, and there should be a focus on these behaviors to prevent the occurrence of these chronic diseases, especially metabolic diseases. Obesity is the main concern which may facilitate the developing of hypertension, asthma, diabetes, high cholesterol, G6PD, hypothyroidism, hyperthyroidism, diabetes, sickle cell disease and cardiovascular events. This study is had missed the nature of the lifestyle and its influences on these dietary habits such as physical activity, smoking and/or social/psychological status.

## Limitation of the study

A small sample size and belonging to one area of eastern province created a selection bias. Therefore, the generalization of the results would not be possible. Furthermore, the responses of regarding eating pattern and their chronic diseases are based on self-administered questionnaire which may have recall bias again created bias in the association of different variables

#### **ACKNOWLEDGEMENTS**

The authors wish to acknowledge the contribution of Abdullah Ali Bu Jubarah, Pharm D, and Ali A. Alkhars medical student at Imam Abdulrahman Bin Faisal University for their input and cooperation in collecting the data.

Funding: No funding sources Conflict of interest: None declared

Ethical approval: The study was approved by the

Institutional Ethics Committee

## **REFERENCES**

- 1. Anderson G. Chronic conditions: making the case for ongoing care. Baltimore, MD: John Hopkins University; 2004.
- 2. Kung HC, Hoyert DL, Xu JQ, Murphy SL. Deaths: final data for 2005. National Vital Statistics Rep. 2008;56(10):1-120.
- 3. Hyattsville, National Center for Health Statistics. Health, United States, 2007. With chartbook on trends in the health of Americans. National Center Health Statistics; 2007.
- Centers for Disease Control and Prevention. National diabetes fact sheet, 2007. Atlanta, GA: U.S. Department of Health and Human Services; 2008.
- 5. Ogden CL, Carroll MD, Flegal KM. High body mass index for age among US children and adolescents, 2003–2006. JAMA. 2008;299:2401–5.
- Freedman DS, Dietz, WH, Srinivasan SR, Berenson GS. The relation of overweight to cardiovascular risk factors among children and adolescents: the Bogalusa Heart Study. Pediatrics. 1999;103:1175– 82.
- 7. Centers for Disease Control and Prevention. Prevalence of doctor-diagnosed arthritis and arthritis-attributable activity limitation. United States, 2003–2005. MMWR. 2006;55:1089-92.
- 8. Whiting DR, Guariguata L, Weil C, Shaw J. IDF Diabetes Atlas: global estimates of the prevalence of diabetes for 2011 and 2030. Diabetes Res Clin Pract. 2011;94(3):311–21.
- 9. Al-Nozha MM, Abdullah M, Arafah MR, Khalil MZ, Khan NB, Al-Mazrou YY, et al. Hypertension in Saudi Arabia. Saudi Med J. 2007;28(1):77-84.
- Al-Daghri NM, Al-Attas OS, Alokail MS, Alkharfy KM, Louie SB, Sabico, et al. Chrousos. Decreasing Prevalence of the Full Metabolic Syndrome but a Persistently High Prevalence of Dyslipidemia among Adult Arabs. PLoS One. 2010;5(8):e12159.
- 11. Al-Nozha MM, Al-Mazrou YY, Al-Maatouq MA, Arafah MR, Khalil MZ, Khan NB, et al. Obesity in Saudi Arabia. Saudi Med J. 2005;26:824–9.
- 12. Al-Nozha MM, Arafah MR, Al-Mazrou YY, Al-Maatouq MA, Khan NB, Khalil MZ, et al. Coronary artery disease in Saudi Arabia. Saudi Med J. 2004;25:1165–71.
- 13. Akbar DH, Ahmed MM, Al-Mughales J. Thyroid dysfunction and thyroid autoimmunity in Saudi type 2 diabetics. Acta Diabetol. 2006;43:14–8.
- 14. Alotaibi M, Sickle cell disease in Saudi Arabia: A challenge or not. J Epidemiol Global Health. 2017;7(2):99-101.
- 15. Amin TT, Al-Sultan AI, Ali A. Overweight and obesity and their relation to dietary habits and socio-

- demographic characteristics among male primary school children in Al-Hassa, Kingdom of Saudi Arabia. Eur J Nutr. 2008;47(6):310-8.
- 16. Mahfouz AA, Abdelmoneim I, Khan MY, Daffalla AA, Diab MM, Al-Gelban KS, et al. Obesity and Related Behaviors among Adolescent School Boys in Abha City, Southwestern Saudi Arabia. J Trop Pediatr. 2007;54(2):120–4.
- 17. Al-Mutairi RL, Bawazir AA, Ahmed AE, Jradi H. Health Beliefs Related to Diabetes Mellitus Prevention among Adolescents in Saudi Arabia, Sultan Qaboos Univ Med J. 2015;15(3):398–404.
- 18. Centers for Disease Control and Prevention. Chronic diseases and their risk factors: the nation's leading causes of death. Atlanta: Centers for Disease Control and Prevention, 1999.
- Quirk-Baillot D, Flament MF, Allen A, Obeid N, Remy B, Falissard B, et al. The Attitudes and Patterns of Eating (APE) Questionnaire: Development and factor analysis in a U.S. Adolescent Community Sample. 2012;17(2):147-56.
- 20. Gosadi IM. Assessment of the environmental and genetic factors influencing prevalence of metabolic syndrome in Saudi Arabia. Saudi Med J. 2016;37(1):12–20.
- 21. Al-Rubeaan KA, Al-Manaa HA, Khoja TA, Al-Sharqawi AH, Aburisheh KH, Youssef AM, et al. Health care services provided to type 1 and type 2 diabetic patients in Saudi Arabia. Saudi Med J. 2015;36(10):1216-25.
- 22. Adnan M, Karim S, Khan S, Al-Wabel NA. Comparative evaluation of metered-dose inhaler technique demonstration among community pharmacists in Al Qassim and Al-Ahsa region, Saudi-Arabia. Saudi Pharm J. 2015;23(2):138–42.
- Ahmed AM, Hersi A, Mashhoud W, Arafah MR, Abreu PC, Al Rowaily MA, et al. Cardiovascular risk factors burden in Saudi Arabia: The Africa Middle East Cardiovascular Epidemiological (ACE) study. Journal of the Saudi Heart Association. PLoS One. 2014;9(8):e102830.
- 24. Luppino FS, de Wit LM, Bouvy PF, Stijnen T, Cuijpers P, Penninx BW, et al. Overweight, obesity, and depression: a systematic review and meta-analysis of longitudinal studies. Arch Gen Psychiatry. 2010;67(3):220-9.
- 25. Hoare E, Skouteris H, Fuller-Tyszkiewicz M, Millar L, Allender. Associations between obesogenic risk factors and depression among adolescents: a systematic review. S Obes Rev. 2014;15(1):40-51.
- 26. Di Pilla M, Bruno RM, Taddei S, Virdis A. Gender differences in the relationships between psychosocial factors and hypertension. 2016;93:58–64.
- 27. World Health Organization. World Health Statistics 2012. France: World Health Organization; 2012.
- 28. Khaodhiar L, Cummings S, Apovian CM. Treating diabetes and prediabetes by focusing on obesity management. Curr Diab Rep. 2009;9:348–54.

29. Poirier P, Giles TD, Bray GA, Hong Y, Stern JS, Pi-Sunyer FX, et al. Obesity and cardiovascular disease: pathophysiology, evaluation, and effect of weight loss. Arterioscler Thromb Vasc Biol. 2006;26:968.

Cite this article as: Sayegh HAA, Qurini AAA, Khan AS, Ibrahim S. Patterns of eating associated with the chronic diseases in Al-Ahsa, Saudi Arabia. Int J Community Med Public Health 2017;4:3517-23.