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A narrative review of nutritional status among Iraqi adults with type 2 diabetes

Sumayah Rafid Mahmood
Institute of Social Sciences, University Putra Malaysia, Malaysia, 43400 Sendanor, Malaysia | Department of Dietetics, Faculty of Medicine and Health Sciences, University Putra Malaysia, Malaysia, 43400 Sendanor, Malaysia Tel +60193158097
Email: sumayahrafid@gmail.com

Barakatun-Nisak Mohd Yusof
Institute of Social Sciences, University Putra Malaysia, Malaysia, 43400 Sendanor, Malaysia | Department of Dietetics, Faculty of Medicine and Health Sciences, University Putra Malaysia, Malaysia, 43400 Sendanor, Malaysia
Corresponding author email: bnisak@upm.edu.my

Hakimah Sallehuddin
Department of Medicine, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia, 43400 Sendanor, Malaysia

Mohammed Asaad Albayaty
Department of family and community medicine, Al-kindy medical college, University of Baghdad

Noraida Omar
Department of Dietetics, Faculty of Medicine and Health Sciences, University Putra Malaysia, Malaysia, 43400 Sendanor, Malaysia | Malaysian Research institute on Ageing (MyAgeing), University Putra Malaysia, 43400 Serdang, Selangor, Malaysia

***Abstract*---**Type 2 diabetes is a global public health problem especially in middle east countries and Iraq has not spared from this pandemic. The prevalence in Iraq and rank in Middle East. Besides increasing in prevalence- also poor glucose control. Nutrition plays a critical role. This paper narratively review variables that affect reduce the incidence of T2DM in Iraq and affect nutritional status among Iraqi withT2DM. The factors contribute to T2DM were high rates of obesity and overweight, as well as levels of body fat indicate a high prevalence of poor glycemic control. Likewise, levels of physical activity are low among older Iraqis.

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Introduction

Diabetes mellitus is a chronic metabolic disease that causes high blood glucose levels due to insulin deficiency or insulin resistant, 95% most common Type 2 Diabetes (T2DM) (WHO, 2016). Diabetes is a significant global health burden, and its prevalence is expected to increase in the coming decades (Guariguata et al., 2014). Assessment in 2018 found that there is more than 500 million cases of T2DM around the world (Kaiser, Zhang, & Van Der Pluijm, 2018), around 1 in 11 adults globular have diabetes mellitus, 90% of whom have T2DM (Zheng, Ley, & Hu, 2018). The prevalence of diabetes in the Middle Eastern and North Africa (MENA) region is 12.2% and is expected to reach 96.2% in 2035 (IDF, 2019). T2DM has improved tremendously over the years and Iraq has not been spared this health problem. In Iraq, the prevalence of T2DM was about 15%, and the highest was recorded in Basrah City (19.7%) (A. A. Mansour et al., 2014).

Without a proper management, excessive rise in blood glucose would lead to diabetes-related complications (WHO, 2019). The glycemic control for patients with T2DM can be assessed using HbA1c, and the target is set at less than 7% (Jefferies et al., 2018). A high HbA1c of more than 7% put patients with T2DM at risk of developing various diabetes-related complications, including heart attack, stroke, vision loss, leg amputation, kidney failure and potential nerve damage (Jefferies et al., 2018). Indeed, these complications would also affect multiple organs that has been associated with an increased in years lost and premature death. (WHO, 2018). Therefore, optimal glycemic control of HbA1c < 7% has been shown to reduce the risk of complications associated with diabetes (Jefferies et al., 2018).

In Iraq, besides the increasing prevalence of T2DM, among those with T2DM, their glycemic control are less than optimal. For example, in Basra, Iraq, a study reported that 86% of patients had poor glycemic control, as indicated by HbA1c > 7% (Mansour, 2020). Another study conducted in Misan, Iraq, found that around 73% of T2DM patients had poor glycemic control (Yaseen & Atyia, 2018). Hence, it has become no surprise that diabetes-related complications are common among Iraqi patients with T2DM (Al-Hilaly, 2018). In a cross-sectional study in Baghdad, Iraq, more than half (54%) of their patients had diabetic foot ulcers, and 20% had a severe disability (Al-Banna & Khuder, 2015). Uncontrolled diabetes, coupled with an increasing prevalence of obesity, will double the public health burden in Iraq.

The rising prevalence of T2DM and the unmet needs of patients with T2DM are concerns to the Iraqi government. The health issue would give a substantial economic burden of medical costs, disability and lost productivity (A. M. Hussain & Lafta, 2019). In addition, the unfinished armed conflict has disrupted the Iraqi healthcare system, underscoring the importance of understanding the health status of individuals with T2DM (Al Hilfi, Lafta, & Burnham, 2013). After decades of war, sanctions and occupation, Iraqi healthcare struggles to regain lost momentum (Al Hilfi et al., 2013). For example, until now, Iraq is one of the

countries in Eastern Mediterranean Region (MER) that does not have detailed official data for foo-based guidelines not only for diabetes but also for a general population (Montagnese, 2019). This led to a reliance on recommendations in the neighbouring Arab country, which may lead to impractical recommendations due to slightly different in culture and food choices

Due to the high prevalence of T2DM and high prevalence of poor glycemic control among Iraqis. Therefore, it is essential to understand the factors that contribute to diabetes. There is a need to study variables that affect reduce the incidence of T2DM in Iraq and affect nutritional status among Iraqi withT2DM. These variables can then be used to reduce the incidence of T2DM in Iraq. Furthermore, Iraq differs from the other countries in the region because of its culture, lifestyle, political factors, and economic situation. Therefore, this paper aims to know the effect of nutritional status to contribute diabetes among Iraqi.

Nutritional status

The assessment of nutritional status may involve estimates of food intake, and anthropometric, biochemical and immune tests (Durnin & Fidanza, 1985). Proper nutrition is the single most important component of preventative health care. Heart disease, diabetes, and other ailments are all linked to dietary habits. Accurate nutritional assessment can be a matter of life or death (Sauberlich, 2018). It has long been known that nutritional deficiencies are associated with morbidity and mortality in hospitalized patients (Hark, Ashton, & Deen, 2011).

The effect of nutrition on T2DM

Medical nutrition therapy (MNT) is defined as "Nutritional diagnostic, therapy, and counseling services for the purpose of disease management which are furnished by a registered dietitian or nutrition professional (Staff et al., 2000). MNT is an effective intervention for the management of obesity, prediabetes, and diabetes, which have all increased dramatically in the United States and worldwide over the last 30 years (Zhou et al., 2016). Medical nutrition therapy (MNT) provided by registered dietitian nutritionists (RDNs) is effective in improving medical outcomes and quality of life, and is cost-effective (Early, Stanley, & Dietetics, 2018). MNT provided by RDNs is also successful and essential to preventing progression of prediabetes and obesity to type 2 diabetes. It is essential that MNT provided by RDNs be integrated into health care systems and public health programs and be adequately reimbursed (Early et al., 2018). The Academy's evidence-based nutrition practice guidelines for the prevention of diabetes and the management of diabetes document strong evidence supporting the clinical effectiveness of MNT provided by RDNs (Early et al., 2018).

Anthropometric data

The pathophysiology of T2DM is mainly related to insulin resistance and closely related to obesity (Sezer, 2017). Obesity increases the number of adipose tissues, and these adipose tissues produced an excessive amount of glycerol (I. J. Neeland, Hughes, Ayers, Malloy, & Jin, 2017; Rotondo et al., 2017; Wondmkun, 2020), proinflammatory cytokines, and non-esterified fatty acids leading to the

development of insulin resistance (Wondmkun, 2020). The combined aetiology of insulin resistance and pancreatic B-cell dysfunction leads to blood glucose abnormalities (Esser, Utzschneider, & Kahn, 2020). β-cell dysfunction stimulates the pancreatic cells to react through different compensatory mechanisms, resulting in increased β-cell mass or augmented replication. The increased demand for insulin during pregnancy and insulin resistance is satisfied by the plasticity of β-cells (Aguayo-Mazzucato & Bonner-Weir, 2018).

Approximately 80.1% of T2DM patients are overweight or obese (Mansour, 2020). Bertoglia et al. (2017) found that more than half of the risk of T2DM could be avoided if the patient was not obese. Similarly, about 23% of T2DM was prevented in obese patients. As noted above, obesity increases the amount of adipose tissue and this adipose tissue results in excessive amounts of glycerol (Neeland, 2017; Rotondo et al., 2017; Wondmkun, 2020), pro-inflammatory cytokines and non-esterified fatty acids. leads to the development of insulin resistance (Wondmkun, 2020). In overweight and obese individuals with T2DM, weight loss and reduced BMI prevent complications and improve glycemic control (Klein et al., 2004).

Obese among Iraqi

In Iraq, about 65.4% of the adult population is overweight (31.9%) or obese (33.5%) (MOH, 2016). The prevalence of obesity in Iraq is 21.8 - 30.4% and overweight 63.5 - 67.9%, the prevalence of obesity in men is 24% and women 36% (Ataey, 2020). The increasing prevalence of obesity is consistent with T2DM in Iraq. The prevalence of T2DM in Iraq and Baghdad was 10.2% and 12%, respectively (MOH, 2016). This high prevalence is worrying because obesity is a major cause of several diseases. It is clear that there are many other diseases in the treatment of obesity, especially T2DM (Golden, 2020).

Biochemical and clinical data

Biochemical data in this context refer to FBG and HbA1C; In a person with T2DM, optimal glycemic status, usually determined using fasting blood glucose (FBG) and glycated hemoglobin A1c (HbA1c), is critical to prevent the development of diabetes-related complications (Organization, 2019). HbA1c levels < 7% and FBG < 5.6 mmol/L aim to indicate optimal glycemic control (Ma et al., 2020). It is common to observe that higher levels of HbA1c and FBG are associated with diabetes status, with individuals with T2DM having higher levels of HbA1c and FBG than those without DMT2 (Bener, 2016; Dhas, 2019; Sheth, 2015).

Study conducted in Duhok, Iraq, the proportion of respondents with normal FBG (54.1%) was better than Salih et al. (2021), where they had only 38% with normal FBG. Similarly, the proportion of pre-diabetes was lower in this study (2.9%) than Salih et al. (2021) (18.4%). The difference may be related to all persons with FBG above 5.6 mmol/L were excluded from the group non-T2DM.It affects one in five adults in this population (Almetwazi, 2017). Besides that, only 14-27% of T2DM patients in Iraq met the glycaemic target (<7%) (Hashim et al., 2020; Mansour, 2020; Yaseen & Atyia, 2018). Therefore, it is not surprising that most people with T2DM also experience complications related to diabetes (Al-Hilaly, 2018). In Iraq, for example, about 54% of T2DM patients have a diabetic foot (Al-Banna &

Khuder, 2015), and 66% of T2DM patients have retinopathy (Al-Hilaly, 2018). Chronic hyperglycemia exposure affects the microvasculature, which in turn causes diabetic nephropathy, retinopathy, and neuropathy (Faselis et al., 2020) . Adherence, physical activity, diabetes education, and exercise program also influence optimal glycemic control (Haghighatpanah et al., 2018). It has been found that diabetes complications are higher in patients with poor glycemic control and T2DM (Yigazu & Desse, 2017).

Dietary intake

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Study conducted in Australia found more than half of T2DM cases could be preventable through modifying health behavior (Dow et al., 2019), These results could serve as a basis for prevention programs based on lifestyle modification (Dow et al., 2019). They found that 32% high fruit adherence and 44% dairy recommendations were directly related to a reduced risk of T2DM (Dow et al., 2019). In addition, based on the Australian Dietary Guidelines 3.2 servings of fruit daily have been associated with a reduced risk of T2DM (Dow et al., 2019). However, exceeding the recommended consumption limit for fruit does not appear to be useful for preventing the risk of T2DM (Dow et al., 2019). On the other hand, increased milk intake was strongly associated with a reduced risk of T2DM (Dow et al., 2019). In addition, strict adherence to recommendations for vegetables, whole grains, and high protein foods was not associated with the risk of T2DM. The number of servings of vegetables and whole grains was not significantly associated with T2DM, while an increase in protein-rich foods was associated with a 56% increased risk (Dow et al., 2019). Eating carbohydrates between 50–60% energy intake and 30–40% from fat were associated with decreased all-cause mortality risk, and well-balanced macronutrient consumption can help prolong lifespan (Kwon, Lee, Park, & Lee, 2020). The recommendations to reduce the risk of T2DM in high-risk groups include (restrict energy intake, lower total and saturated fat intake, and increase fibre intake and moderate carbohydrate restriction (Dyson et al., 2011).

Current intake

Average energy intake of the subjects was 2032.7 ± 274.6 kcal/day with the contribution of energy from carbohydrate (58.7%), protein (17.3%) and fat (24.0%) were in line with the professional bodies recommendations. Dietary GI and GL of the subjects were 59.7 ± 3.8 and 21.8 ± 3.8 respectively which were generally higher as compared to the other Middle East studies (AL HASNAWI, 2015). The study condcuted in Basrah, Iraq found the effectiveness of the Simplified Diabetes Nutrition Education among patients with T2DM improved the HbA1c significantly among the intervention group compared to the control group (Hashim et al., 2021).

Nutrients deficiency

The current diet shows a clear shift towards processed foods (Popkin & Reardon, 2018). Processed foods are high in added sugars, saturated or trans fats, sodium, and high-calorie foods, which play an essential role in increasing non-communicable diseases (NCDs) (WHO, 2019). In contrast, intake of nuts, whole

grains, and other vegetables was significantly reduced (Popkin & Reardon, 2018). Malnutrition and micronutrient deficiencies are caused by insufficient nutrient intake (Galal, 2002). There was a lack of information about micronutrient and macronutrient among Iraq.

In the Eastern Mediterranean, diseases associated with overnutrition such as obesity, heart disease, diabetes and cancer coexist with malnutrition and micronutrient deficiencies(C. Montagnese et al., 2019).. Higher whole grain cereal intakes are associated with substantially lower risks of type 2 diabetes, coronary heart disease, and hypertension. Mechanisms for the effect of whole grains on health. Firstly, to maintain health. Secondly, aleurone in bran is a critical grain component generally overlooked in favor of indigestible fiber. Live aleurone cells constitute 50% of millers' bran. They store minerals, protein, and the antioxidant ferulic acid, and are clearly more than just indigestible fiber. Finally, we suggest potential roles for magnesium, zinc, and ferulic acid in the development of chronic disease (Lillioja, Neal, Tapsell, & Jacobs Jr, 2013).
It is clear that proper nutrition plays a vital role in preventing and controlling T2DM (Mozaffarian, 2020).

Vitamin D

In addition, the role of vitamin D and T2DM risk development is emerging. Vitamin D, also known as the sunshine vitamin, can be obtained via moderate sun exposure, fatty fish consumption, vitamin D-fortified foods, and vitamin D supplements (Van Schoor & Lips, 2017). Vitamin D plays a critical role in improving insulin secretion, glucose metabolism, reducing inflammation, enhancing immune function, and regulating metabolism. A study has shown that vitamin D deficiency (VDD) may reduce insulin sensitivity and increase insulin resistance (Das, 2017). Among those with T2DM, vitamin D plays a vital role in regulating blood glucose levels (Van Schoor & Lips, 2017). Vitamin D plays a critical role in improving insulin secretion, glucose metabolism, reducing inflammation, enhancing immune function, and regulating metabolism. A study has shown that vitamin D deficiency (VDD) may reduce insulin sensitivity and increase insulin resistance (Das, 2017). The role of vitamin D is emerging and considered a pertinent factor in Iraq which warrants further investigation. In the non-diabetes Iraqi population, few studies have shown that a low vitamin D level is commonly observed, ranging from 60 to 80% (Abdullah, Abdulrahman, & Omer, 2018; S. F. Salih & Al-Timimi, 2016). Almost 82% of adults from Sulaymaniyah, Iraq, had a vitamin deficiency (Abdullah et al., 2018). Similarly, about 78% of Erbil, Iraq, had a VDD (Abdulrahman.

Other factors influencing diabetes control in Iraq

Previously mentioned the poor glycemic control spread among Iraqi adult. To find which factors associated with poor glycemic control among Iraqi T2DM patients risk factors for poor glycemic control in T2DM in Iraq include younger age, women, longer disease duration, high baseline HbA1c, insulin treatment, overweight and obesity, and lack of treatment for hypertension (Mansour, 2020). They found that a sedentary lifestyle, overweight, excessive energy intake, and obesity are common traits that predict poor glycemic status (AL HASNAWI, 2015).

In addition, genetic predisposition, obesity, and lack of physical activity are risk factors for developing T2DM (Hussain, 2018). Another study in Baghdad, Iraq found that factors that contribute to glycemic status in T2DM include older age, diet alone, and low physical activity (Al-Hasnawi, MY, Hazizi, & Rafi, 2015). Factors that contribute to poor glycemic control include age, body mass index (BMI), fasting blood glucose (FBG), low education level, and low health literacy (Hashim et al., 2020).

In Iraq, the prevalence of T2DM increased significantly, peaking between the ages of 40-59 (Mansour, 2008). Mansur et al. (2020) reported that factors associated with high HbA1c in Iraqi T2DM patients included younger patients, female gender, long disease duration, initially high HbA1c levels, dyslipidemia, insulin therapy, overweight, obesity, and hypertension. In another study conducted in Iraq, about 79.9% of respondents had HbA1C levels that were not well controlled due to low self-efficacy and self-management (Mohammad, 2018). Understanding nutritional status is very important, as an Iraqi study found that sedentary lifestyle, overweight, excessive energy intake, and obesity are dietary factors that predict poor glycemic control (Al-Hasnawi et al., 2015).

Conclusions

In general, high rates of obesity and overweight, as well as levels of body fat indicate a high prevalence of poor glycemic control. Likewise, levels of physical activity are low among older Iraqis. There is limited nutritional research among Iraqis and no recommendations or guidelines on total energy intake, carbohydrate intake, protein intake and fat intake. Further research on intention studies promotes weight loss, switching to a healthier diet, vitamin D intake and exercise to prevent T2DM.

References

Aguayo-Mazzucato, C., & Bonner-Weir, S. (2018). Pancreatic β cell regeneration as a possible therapy for diabetes. Cell metabolism, 27(1), 57-67.

Al-Banna, D. A., & Khuder, S. A. (2015). Disability assessment of diabetic patients in Erbil city. Zanco Journal of Medical Sciences (Zanco J Med Sci), 19(1), 902_909-902_909.

Al-Hasnawi, A. K., MY, B. N., Hazizi, A., & Rafi, A.-R. (2015). Nutritional Status-Related Factors Contribute to Poor Glycemic Status in a Sample of Iraqi Patients with Type 2 Diabetes.

Al-Hilaly, I. A. H. (2018). A study of diabetic retinopathy in type 2 diabetic patients and its relation with diabetic progression. Al-Kufa University Journal for Biology, 10(1), 24-34.

AL HASNAWI, A. K. A. (2015). FACTORS ASSOCIATED WITH GLYCEMIC STATUS AMONG TYPE 2 DIABETES MELLITUS PATIENTS IN MERJAN DIABETIC CENTRE, IRAQ.

Al Hilfi, T. K., Lafta, R., & Burnham, G. (2013). Health services in Iraq. The Lancet, 381(9870), 939-948.

Almetwazi. (2017). The association of vitamin D deficiency and glucose control among diabetic patients. 25(8), 1179-1183.

Ataey. (2020). The relationship between obesity, overweight, and the human development index in world health organization eastern mediterranean region countries. 53(2), 98.

Bener. (2016). The role of vitamin D, obesity and physical exercise in regulation of glycemia in Type 2 Diabetes Mellitus patients. Diabetes & Metabolic Syndrome: Clinical Research & Reviews, 10(4), 198-204.

Das, G. (2017). Vitamin D and type 2 diabetes. Practical Diabetes, 34(1), 19-24b.

Dhas. (2019). Association of vitamin D deficiency with insulin resistance in middle-aged type 2 diabetics. Clinica Chimica Acta, 492, 95-101.

Dow, C., Balkau, B., Bonnet, F., Mancini, F., Rajaobelina, K., Shaw, J., . . . Fagherazzi, G. (2019). Strong adherence to dietary and lifestyle recommendations is associated with decreased type 2 diabetes risk in the AusDiab cohort study. Preventive medicine, 123, 208-216.

Durnin, J., & Fidanza, F. J. B. n. e. d. (1985). Evaluation of nutritional status. (35), 20-30.

Dyson, P., Kelly, T., Deakin, T., Duncan, A., Frost, G., Harrison, Z., . . . Mellor, D. (2011). Diabetes UK evidence-based nutrition guidelines for the prevention and management of diabetes. Diabetic Medicine, 28(11), 1282-1288.

Early, K. B., Stanley, K. J. J. o. t. A. o. N., & Dietetics. (2018). Position of the Academy of Nutrition and Dietetics: the role of medical nutrition therapy and registered dietitian nutritionists in the prevention and treatment of prediabetes and type 2 diabetes. 118(2), 343-353.

Esser, N., Utzschneider, K. M., & Kahn, S. E. (2020). Early beta cell dysfunction vs insulin hypersecretion as the primary event in the pathogenesis of dysglycaemia. Diabetologia, 63(10), 2007-2021.

Faselis, C., Katsimardou, A., Imprialos, K., Deligkaris, P., Kallistratos, M., & Dimitriadis, K. J. C. v. p. (2020). Microvascular complications of type 2 diabetes mellitus. 18(2), 117-124.

Galal, O. M. J. P. h. n. (2002). The nutrition transition in Egypt: obesity, undernutrition and the food consumption context. 5(1a), 141-148.

Golden, A. (2020). Obesity-Related Complications. In Treating Obesity in Primary Care (pp. 61-86): Springer.

Guariguata, L., Whiting, D. R., Hambleton, I., Beagley, J., Linnenkamp, U., & Shaw, J. E. (2014). Global estimates of diabetes prevalence for 2013 and projections for 2035. Diabetes research and clinical practice, 103(2), 137-149.

Haghighatpanah, M., Nejad, A. S. M., Haghighatpanah, M., Thunga, G., Mallayasamy, S. J. O. p. h., & perspectives, r. (2018). Factors that correlate with poor glycemic control in type 2 diabetes mellitus patients with complications. 9(4), 167.

Hark, L., Ashton, K., & Deen, D. J. C. N. (2011). Nurse Practitioner's.

Hashim, S. A., Barakatun-Nisak, M. Y., Abu Saad, H., Ismail, S., Hamdy, O., & Mansour, A. A. (2020). Association of Health Literacy and Nutritional Status Assessment with Glycemic Control in Adults with Type 2 Diabetes Mellitus. Nutrients, 12(10), 3152.

Hashim, S. A., Yusof, B.-N. M., Saad, H. A., Ismail, S., Hamdy, O., & Mansour, A. A. J. C. n. E. (2021). Effectiveness of simplified diabetes nutrition education on glycemic control and other diabetes-related outcomes in patients with type 2 diabetes mellitus. 45, 141-149.

Hussain. (2018). Adiponectin gene polymorphisms as a predictor for development of type 2 diabetes mellitus in Iraqi population. 662, 118-122.

Hussain, A. M., & Lafta, R. K. J. S. m. j. (2019). Burden of non-communicable diseases in Iraq after the 2003 war. 40(1), 72.
IDF. (2019). International Diabetes Federation.
Jefferies, C., Rhodes, E., Rachmiel, M., Chizo, A. J., Kapellen, T., Abdulla, M. A., & Hofer, S. E. (2018). ISPAD Clinical Practice Consensus Guidelines 2018: Management of children and adolescents with diabetes requiring surgery. Pediatr Diabetes, 19(Suppl 27), 227-236.
Kaiser, A. B., Zhang, N., & Van Der Pluijm, W. (2018). Global prevalence of type 2 diabetes over the next ten years (2018-2028). In: Am Diabetes Assoc.
Klein, S., Sheard, N. F., Pi-Sunyer, X., Daly, A., Wylie-Rosett, J., Kulkarni, K., & Clark, N. G. (2004). Weight management through lifestyle modification for the prevention and management of type 2 diabetes: rationale and strategies. A statement of the American Diabetes Association, the North American Association for the Study of Obesity, and the American Society for Clinical Nutrition. The American journal of clinical nutrition, 80(2), 257-263.
Kwon, Y.-J., Lee, H. S., Park, J.-Y., & Lee, J.-W. (2020). Associating Intake Proportion of Carbohydrate, Fat, and Protein with All-Cause Mortality in Korean Adults. Nutrients, 12(10), 3208.
Lillioja, S., Neal, A. L., Tapsell, L., & Jacobs Jr, D. R. J. B. (2013). Whole grains, type 2 diabetes, coronary heart disease, and hypertension: links to the aleurone preferred over indigestible fiber. 39(3), 242-258.
Mansour. (2008). Diabetes screening in Basrah, Iraq: a population-based cross-sectional study. 79(1), 147-150.
Mansour. (2020). Prevalence and correlation of glycemic control achievement in patients with type 2 diabetes in Iraq: A retrospective analysis of a tertiary care database over a 9-year period. 14(3), 265-272.
Mansour, A. A., Al-Maliky, A. A., Kasem, B., Jabar, A., Mosbeh, K. A. J. D., metabolic syndrome, targets, o., & therapy. (2014). Prevalence of diagnosed and undiagnosed diabetes mellitus in adults aged 19 years and older in Basrah, Iraq. 7, 139.
MOH. (2016). Annual statistical report 2016, Ministry of Health. . Retrieved from
Mohammad, A. H. (2018). Role of management modalities in control and development of complications in diabetic patient, in Thi-Qar province. University of Thi-Qar Journal of Science, 6(4), 97-105.
Montagnese. (2019). Food-based dietary guidelines around the world: eastern Mediterranean and Middle Eastern countries. 11(6), 1325.
Montagnese, C., Santarpia, L., Iavarone, F., Strangio, F., Sangiovanni, B., Buonifacio, M., . . . Pasanisi, F. (2019). Food-based dietary guidelines around the world: eastern Mediterranean and Middle Eastern countries. Nutrients, 11(6), 1325.
Mozaffarian, D. (2020). Dietary and policy priorities to reduce the global crises of obesity and diabetes. Nature Food, 1(1), 38-50.
Neeland. (2017). Effects of visceral adiposity on glycerol pathways in gluconeogenesis. 67, 80-89.
Neeland, I. J., Hughes, C., Ayers, C. R., Malloy, C. R., & Jin, E. S. (2017). Effects of visceral adiposity on glycerol pathways in gluconeogenesis. Metabolism, 67, 80-89.
Organization, W. H. (2019). Classification of diabetes mellitus.
Popkin, B. M., & Reardon, T. (2018). Obesity and the food system transformation in Latin America. Obesity Reviews, 19(8), 1028-1064.

Rotondo, F., Ho-Palma, A. C., Remesar, X., Fernández-López, J. A., del Mar Romero, M., & Alemany, M. (2017). Glycerol is synthesized and secreted by adipocytes to dispose of excess glucose, via glycerogenesis and increased acyl-glycerol turnover. Scientific reports, 7(1), 1-14.

Sauberlich, H. E. (2018). Laboratory tests for the assessment of nutritional status: Routledge.

Sezer, H. (2017). Insulin resistance, obesity and lipotoxicity. Obesity and lipotoxicity, 277-304.

Sheth. (2015). Does vitamin D play a significant role in type 2 diabetes? , 15(1), 1-7.

Staff, I. o. M., Beneficiaries, I. o. M. C. o. N. S. f. M., Medicine, I. o., Board, N., Staff, N. B., & Beneficiaries, C. o. N. S. f. M. (2000). The role of nutrition in maintaining health in the nation's elderly: Evaluating coverage of nutrition services for the Medicare population: National Academy Press.

WHO. (2016). World Health Organization. (2016). WHO : Global Database on Body Mass Index. Retrieved from http://apps.who.int/bmi/index.jsp?introPage=intro_3.html. In.

WHO. (2018). Global report on diabetes: executive summary. 2016. In.

WHO. (2019). World Health Organization, Regional Office for the Eastern Mediterranean. Noncommunicable Diseases in the Eastern Mediterranean Region. Available online: https://apps.who.int/iris/handle/10665/250371WorldHealthOrganization/Eastern (accessed on 26 April 2019).

Wondmkun, Y. T. (2020). Obesity, insulin resistance, and type 2 diabetes: associations and therapeutic implications. Diabetes, Metabolic Syndrome and Obesity: Targets and Therapy, 13, 3611.

Yaseen, Y. O., & Atyia, J. J. (2018). Facts about type 2 diabetes mellitus and its control in Misan Governorate. Single-center experience. The medical journal of Basrah university, 36(2), 81-86.

Yigazu, D. M., & Desse, T. A. J. B. r. n. (2017). Glycemic control and associated factors among type 2 diabetic patients at Shanan Gibe Hospital, Southwest Ethiopia. 10(1), 1-6.

Zheng, Y., Ley, S. H., & Hu, F. B. (2018). Global aetiology and epidemiology of type 2 diabetes mellitus and its complications. Nature Reviews Endocrinology, 14(2), 88.

Zhou, B., Lu, Y., Hajifathalian, K., Bentham, J., Di Cesare, M., Danaei, G., . . . Taddei, C. J. T. L. (2016). Worldwide trends in diabetes since 1980: a pooled analysis of 751 population-based studies with 4• 4 million participants. 387(10027), 1513-1530.