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The Interaction between Diet and Air Pollution in Association with Type 2 Diabetes Mellitus: Introducing Yazd Health Study

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Type 2 diabetes mellitus (T2DM) is a chronic life threatening metabolic disorder [1]. Its prevalence is increasing globally [2]. In the US, T2DM prevalence has been doubled during the past 20 years [3]. It is also predicted that the number of diabetic people will reach to 380 million by 2025 worldwide [4]. It was also estimated that about four million adults in Iran had T2DM in 2014 which was increased by 35% from 2007 [5].

Diet is one of the major risk factors of T2DM [6]. A recently published meta-analysis showed that "Healthy" dietary patterns containing vegetables, fruits, and whole grains can lower diabetes type II risk by 14%. It also reported that consuming higher amounts of red and processed meats, high-fat dairy and refined grains in the context of unhealthy pattern will increase diabetes risk by 30% [6].

Also, air pollution was proposed to be associated with T2DM[7]. For instance, it is revealed that particulate matter (PM) and also persistent organic pollutants (POPs) have been related to T2DM [7, 8]. It seems that unhealthy dietary behaviors might increase the adverse effects of air pollution on human health. It is known that the air pollution exposure increases the oxidative stress which increases several chronic diseases including cardiovascular diseases (CVDs) and T2DM, moreover, dietary supplementation of antioxidants might modulate the acute effect of air pollutants [9]. We are not aware of any study trying to find the possible interaction between dietary factors and air pollution in relation to T2DM.

Yazd city located in the central part of Iran is one of the driest cities with an average rainfall around 60 millimeters per year [10]. Due to its harsh climate, the area under agriculture is very limited [11]. Unfortunately the prevalence of type 2 diabetes mellitus in Yazd city has reached to an alarming rate of 16.3% [12] which is twice more than the overall prevalence of diabetes in the Iranian adults [13-17]. It is estimated that about one third of Yazd inhabitants are suffering from metabolic syndrome (MetS) [18]. A recently published study conducted in Yazd showed high rates of premature death,

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cardiovascular and respiratory diseases associated with PM_{10} and $PM_{2.5}$ [19]. Furthermore, several studies have revealed that the consumption of fruits and vegetables are low in Yazd people particularly in older adults [20]. Since both diet and air pollution might affect T2DM risk, it seems that population based studies in YAZD may provide a great opportunity in investigating the possible interaction between diet and air pollution in association with chronic diseases, particularly T2DM as the greatest public health concern in Yazd.

The Yazd Health Study (YaHS) is a population based prospective cohort study that has been conducted since 2014 on 10,000 residents of Yazd aged 20-70 years. Our objective was to study non-communicable diseases and their relevant risk factors. Demographic, socio-economic, psychological, lifestyle (physical activity, dietary habits, and beliefs) data and information about current diseases and medication use by participants were gathered using validated questionnaires by trained interviewers in the recruitment phase of the study. Furthermore, various anthropometrics and blood pressure measurements were carried out at the time of enrolment which are then going to be repeated every 4 years. After interview, blood pressure, pulse, and anthropometric measurements study participants were invited to give blood samples so that a biobank was established. Additionally, data on other environmental factors including dietary intakes, using a validated Willett-format food frequency questionnaire (FFQ), exposure to high and low electromagnetic fields, and air pollution are going to be measured at residence place of the participants, in the next stage of the study.

It is planned to repeat all the measurements every four years in order to assess changes occurring in various measured risk factors. Death, disabilities, and other various outcomes were extracted from the aggregated health information system of Yazd hospitals fed into the national SEPAS system. A six-month wash out period was considered to ensure that outcomes are relevant to the measured health factors.

Later, ethical approval was obtained from Ethics Committee of Shahid Sadoughi University of Medical Sciences, No. 17/1/73941. All participants submitted their informed consents to take part in this study. The study was funded by Shahid Sadoughi University of Medical Sciences and was then approved by research council of the university under grant No. 70341 on July 2014. Yazd Health Study (YaHS), as a large scale population-based prospective cohort study tries to provide a good source of data for examining the air pollutants in Yazd. It also investigates the interaction between these data and other environmental factors, particularly nutrition in association with T2DM. The study team welcomes interested researchers submitting related proposals to YAHS team at yahs.ssu.ac.ir.

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