In an attractive scenario, named “WIMP miracle”, thermal freeze-out of dark matter (DM) annihilation in the early universe sets the inferred DM relic abundance. Despite its simple nature, however, this scenario results in overproduction or underproduction of DM in large regions of the parameter space of particle physics models. Moreover, recent experimental results seem to rule out the annihilation rate required by “WIMP miracle” in some interesting cases. On the other hand, within a non-thermal standard history it is possible to obtain the correct relic abundance for both small and large annihilation rates. Dr. Allahverdi will begin this talk by introducing non-thermal production of DM in an early matter-dominated era that commonly arises in supersymmetric and string-inspired models. Focusing on the thermally overproduced case, he will describe various contributions to the DM relic abundance and possible enhancement of small-scale DM perturbations. He will then discuss the necessary conditions to boost the annihilation signal to levels detectable by indirect detection experiments like Fermi. Finally, he will present an explicit implementation of this scenario in a simple extension of the Standard Model that may be also probed via direct detection and collider searches.