

Examining determinants of Metabolic Syndrome in people with Intellectual Disabilities

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Abstract

Introduction: There is growing evidence of an increased risk of Metabolic Syndrome (MetS) in people with Intellectual Disabilities (ID). It is an emerging public health issue. People with ID are particularly vulnerable to the negative sequelae of MetS. Due to the slower learning process, people with ID find it difficult to regulate their dietary habits. Determinants of MetS in this population have not been adequately explored, which is the purpose of this study. Objectives: To identify the determinants of metabolic syndrome in people with intellectual disabilities. Methods: A comprehensive literature search was conducted in MEDLINE (PubMed), CINAHL, and Google Scholar. The following inclusion criteria were used in the selection of the articles: (1) published within the past 10 years; (2) published in the English language; (3) published in peer-reviewed journals; (4) original research concerning MetS including descriptive, epidemiological studies, and (5) focus on ID. Grey literature was not included in the search. Results: A total of nine

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studies met the inclusion criteria. Studies were found to have higher rates of MetS in the order of 25% to 45% in people with ID. Physical inactivity, sedentary lifestyle, living independently in community settings, having the ability to prepare meals, being a woman, lacking access to health education programs, deficiencies in the awareness concerning health as well as the reduced opportunities of engaging in cognitive activities, especially among older-aged women, were found as the major determinants of MetS in ID populations. Conclusions: This study provides insights into certain determinants of MetS in the ID population, which has been neglected in the literature, to the best of our knowledge. Our hope is that interventions can be planned and implemented with ID populations based on the evidence, as highlighted in this study.

Keywords: Intellectual Disability; Metabolic Syndrome; Determinants.

1. Introduction

Metabolic syndrome (MetS) is considered a global epidemic (Saklayen, 2018) and a serious threat to public health (Bankoski, Harris, McClain, Brychta, Caserotti, Chen *et al.*, 2011). MetS is a cluster of diseases. It happens when any three or more conditions out of five including abdominal obesity, elevated blood pressure, elevated blood glucose levels, low high-density lipoprotein cholesterol (HDL-C), and elevated triglycerides meet together (Cornier, Dabelea, Hernandez, Lindstrom, Steig, Stob *et al.*, 2008). According to the definition, abdominal obesity is considered when the waist circumference is equal or more than 40 inches in men and 35 inches in women, blood pressure values are equal or over 130 mmHg systolic and 85 mmHg diastolic, elevated fasting glucose is over 100 mg/dL, HDL-C is 40mg/dL in men and 50 mg/dL in women and elevated triglycerides present a value that is 150 mg/dL or greater (Huang, 2009). Estimates suggest that 11 million deaths can be attributed to metabolic syndrome (MetS), on an annual basis, worldwide (Danaei, Lu, Singh, Carnahan, Stevens, Cowan *et al.*, 2014). The burden of MetS in intellectual disabilities is also increasing. The link between MetS and chronic diseases, including cardiovascular disease, diabetes, arthritis, chronic kidney disease, schizophrenia, and several types of cancer has already been established (Goldberg & Mather, 2012). MetS is also found to be associated with early death (Mottillo, Filion, Genest, Joseph, Pilote, Poirier *et al.*, 2010; Moore, Chaudhary, & Akinyemiju, 2017). The risk of MetS can be reduced substantially by making lifestyle changes (Yamaoka & Tango, 2012). However, it is very difficult for people to make such changes in their lifestyle. The challenge of making lifestyle changes in people with ID is multiple times higher than non-ID people because of their low level of processing skills, behavioral problems, less education and awareness regarding health, high sensitivity towards immediate smaller rewards, and low ability of managing things in their lives (Carmeli, Zinger-Vaknin, Morad, & Merrick, 2005; Lakhan, Sagiraju, Ekundayò, & Sharma, 2019). In recognition of the increasing rate of MetS in all populations, it is imperative that the risk and its negative consequences on health should be studied in the ID population. Determinants of MetS in this section of the population have not been adequately explored, which is the purpose of this study.

2. Objective

The purpose of this study was to identify and discuss determinants of MetS in people with Intellectual Disabilities.

3. Methods

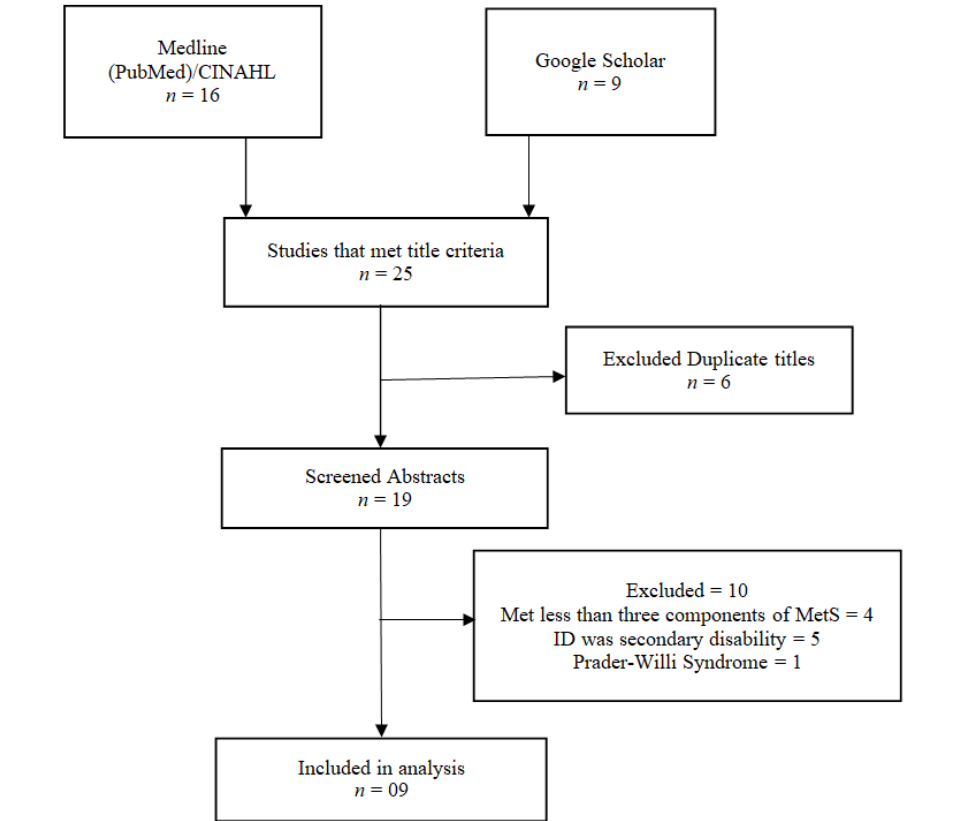
A comprehensive literature search was conducted in MEDLINE (PubMed), CINAHL, and Google Scholar. The following inclusion criteria were used in the selection of the articles: (1) published within the past 10 years; (2) published in the English language; (3) published in peer-reviewed journals; (4) original research concerning MetS including descriptive, epidemiological studies, and (5) focus on ID. The search was conducted with the following two keywords: intellectual disability and metabolic syndrome; mental retardation and metabolic syndrome. We found 15 studies in MEDLINE (PubMed), one in CINAHL, and nine in Google Scholar. After a careful reading of the 25 titles, 6 articles that appeared in our search were excluded as they were duplicate titles and 19 papers were found to be relevant so that their abstracts were read more thoroughly. Ten articles, out of 19, were further excluded for the following reasons: four articles did not cover three components of MetS, five articles used ID as a secondary disability and the last article focused its attention on Prader-Willi Syndrome (please see Fig. 1 for more details).

4. Results

A total of nine studies met the inclusion criteria and looked at the social determinants behind MetS in the ID population. Three studies were conducted in The Netherlands and one each in China, Italy, Sweden, South Korea, Taiwan, and the United Kingdom. Seven studies followed a cross-sectional research design, two analyzed secondary data, and one used a mixed methods design. Studies were found to have higher rates of MetS in the order of 25% to 45% in people with ID. In this review, the major factors determining MetS in people with ID were found to be physical inactivity (30% of studies), the living setting (20%), gender (10%), age (10%), low levels of health education and awareness (10%) and multiple factors (10%), including the use of conventional antipsychotic drugs, age, and low nutrition. Interestingly, one study observed a better outcome of MetS in

terms of better cognitive function in the older female ID population (refer to Tab. 1 for more details).

Figure 1 – *Flow diagram of the literature search process*



5. Discussion

The objective of this study was to identify the determinants of metabolic syndrome (MetS) in the intellectually disabled population through a review of the literature. Several determinants were identified in this review.

Two studies conducted in South Korea (Kim & Yi, 2018) and the United Kingdom (Harris *et al.*, 2018) demonstrated that MetS in people with ID may be due to physical inactivity. Physical inactivity is defined as the lack of moderate to vigorous physical activity and is also called as sedentary behavior. It is a serious concern among all people but seems to be even more important in people with ID and is one of the main modifiable risk factors for MetS (Park, Park, Togo, Watanabe, Yasunaga, Yoshiuchi *et al.*, 2008).

Table 1 – Studies included in the review

Authors	Country	Year	Research design	Population, sample size, and age	Significant findings
Laudisio, Marzetti, Pagano, Cocchi, Franceschi, Bemabei, & Zuccala	Italy	2008	Cross-sectional	333 People with ID age \geq 75 years old	MetS was found to be associated with a better cognition performance in the older female population ($p < .01$)
Wallén, Müllersdorf, Christensson, Mahn, Ekblom, & Marcus	Sweden	2009	Cross-sectional	66 students enrolled in secondary schools and 90 without ID were recruited in the study	Prevalence of cardio-metabolic risk was found to be high in young people with intellectual disabilities
de Winter, Magilsen, van Alfen, Willemisen, & Evenhuis	The Netherlands	2010	Cross-sectional	470 adults with ID were examined in the study, age \geq 50 years old, living in residential organizations	Metabolic syndrome was 25.1% [95% CI 21.0 - 29.3%]. It had a significantly higher risk in people with mild ID
Hsu, Yen, Hung, Lin, Wu, & Lin	Taiwan	2012	Cross-sectional. A secondary annual health checkup data of year 2009 was analyzed	164 people with ID with a mean age of 20 years old were recruited in the study, living in institutions	Prevalence of MetS was found to be 11.6% (8% in males and 17.2% in females). This was lower than that in the general population of Taiwan. OR = 38.35, 95% CI [1.98 - 741.02]
de Winter, Bastiaanse, Hilgenkamp, Evenhuis, & Ehteld	The Netherlands	2012	Cross-sectional	980 people with borderline to profound ID	The rate of MetS was found to be 44.7%. People who lived more independently and people who were able to do groceries or prepare a meal independently had higher risk for MetS 44.5%, 95% CI [40.7% - 48.7%].
Room, Timmermans, & Roodbol	The Netherlands	2016	Mixed-methods design. Medical records of people with and without IDs of a Dutch health care institute were examined	A mixed-methods research design was applied. Medical data and laboratory exams were analyzed for 260 people with ID	MetS in people with IDs was found to be 46%. Conventional antipsychotic drugs (2.4 times (95% CI 1.246 - 4.747), age, and low nutritional score were found to be associated with MetS
Kim and Yi	South Korea	2018	Cross-sectional. Actical (a physical activity monitor) for 5 days and blood samples were taken	A total of 17 people (13 men and 4 women) with ID from 18 to 60 years of age, IQs between 45 to 70	Physical inactivity was found to be a significant factor of high metabolic rate ($p < .05$)
Harris, McGarry, Hilgenkamp, Mitchell, & Melville	UK	2018	A secondary analysis of data from two randomized controlled trials of lifestyle behavior changes was conducted	143 people with ID	Sedentary behavior was found to be significantly associated with a higher risk of MetS ($p < .05$)
Wang, Wong, Taylor-Piliae, Qiu, & Li	China	2019	Cross-sectional	204 people aged 58.5 \pm 10.1 years (55% males)	A low level of knowledge and lack of specific health education were found to be associated with MetS ($p < .001$)

According to the 2003 to 2006 National Health and Nutrition Examination Survey (NHANES) data analysis, people with MetS spend about 67.3% of their time in sedentary behavior (Bankoski *et al.*, 2011). People with ID usually do not hold jobs like most other people in society. If they are not provided with adequate options for staying physically active they tend to become sedentary, which contributes to MetS.

Interestingly, two studies, which were both conducted in The Netherlands, seemed to be in contrast to the previous findings since they reported the living setting to be associated to a higher risk of MetS in people with ID, especially in patients living in a residential setting and having a mild level of ID (de Winter *et al.*, 2010) as well as in individuals living more independently and that were also more likely to purchase groceries and to cook their meals on their own (de Winter *et al.*, 2012). Other studies conducted in the ID population reported that the rate of obesity was higher among those who were older, had less severe ID, were more independent in eating by themselves and were more independent in doing their groceries and cooking their food by themselves (Melville, Hamilton, Hankey, Miller, & Boyle, 2007; Maiano, 2011; Hsieh, Rimmer, & Heller, 2014).

Moreover, people with ID and characterized by a lower level of health education, knowledge, and awareness were found to be more associated with MetS in a study conducted in China (Wang *et al.*, 2019). However, a similar association between a low level of health education and MetS was also observed in the non-ID population (Ramsey & Glenn, 2002).

These findings assume that researchers are referring to people with an ID severity that is less pronounced and that, thus, present a certain capacity for understanding health education and its implications. If this inference is correct then it means that people with less severe ID are more independent in making dietary choices and, as a result, they are more subject to a higher rate of obesity and a consequent higher risk of MetS. Thus, if on the one hand, people with less severe ID are likely to be less sedentary, since they are able to buy their groceries and cook their meals on their own, on the other hand, the fact of being able to make dietary choices of their own makes them more vulnerable to obesity and, consequently, to MetS.

One study found female gender to be highly associated with a higher risk of MetS in people affected by ID (Hsu *et al.*, 2012). This finding was consistent with studies conducted in the non-ID population that demonstrated a higher association between MetS and female gender (Beigh & Jain, 2012; Aguilar, Bhuket, Torres, Liu, & Wong, 2015).

Age was also found to be strongly correlated to a higher risk of MetS in the non-ID population (Aguilar *et al.*, 2015). In our dataset, only one study conducted in Sweden examined the relationship between age and MetS (Wallén *et al.*, 2009). A further paper, instead, which was conducted in The Netherlands, examined the relationship between age and MetS with another ID factor, the intelligence quotient (IQ), reporting that the rate of MetS in the ID population increased with age (de Winter *et al.*, 2012). This can be explained by the fact that people with ID might experience a much greater risk of MetS correlated to age because often adult people with ID lack employment opportunities and live an inactive life, as opposed to their age-matched adults (Khayatzadeh-Mahani, Wittevrongel, Nicholas, & Zwicker, 2019). In fact, in most places children with ID attend some form of school, just like non-ID children, and receive opportunities to engage in various activities but once they cross this school age, they often do not obtain a job like their age-matched non-ID peers, which limits their participation and scope of staying active due to a life set by a fixed routine.

In a mixed-methods research design, conducted in The Netherlands, the researchers found a higher association between the use of conventional psychotropic drugs and MetS in people with ID (Room *et al.*, 2016). A similar association between psychotropic drugs and MetS, however, was also reported for the non-ID population (McIntyre, Park, Law, Sultan, Adams, Lourenco *et al.*, 2010).

MetS was also observed to be often associated with a poor cognitive function in elderly of the non-ID population (Panza, Frisardi, Capurso, Imbimbo, Vendemiale, Santamato *et al.*, 2010; Yates, Sweat, Yau, Turchiano, & Convit, 2012). A study conducted by Laudisio and colleagues found a better cognitive outcome of MetS in older ID women in Italy (Laudisio *et al.*, 2008). Learning more about the implications of MetS on the cognitive functioning in people with ID could be an area of research that should be further investigated.

In conclusion, when it comes to non-modifiable risk factors, including age and gender, and to modifiable risk factors, such as the use of conventional psychotropic drugs and physical inactivity, the association of these factors and MetS was found to be similar in the ID population compared to the non-ID population. However, people with a mild ID severity who were thus relatively independent in eating and preparing their food, and in living either in residential facilities or living independently in community settings, presented a higher risk of MetS compared to the non-ID population since their independence in making dietary choices was

unfortunately correlated to lower levels of health education, knowledge, and awareness, making them more subject to obesity and, thus, to MetS.

6. Limitations and Strengths

This study has a few limitations, including the fact that the search was conducted only through three databases. Moreover, articles published in other languages other than English were not included. Most of the studies included in this review came from European countries, North America, and South Asia. In fact, we were not able to find any peer-reviewed studies on this topic from the Indian subcontinent, Middle East Asia, Africa, South America, and Australia. In addition, the living conditions and health and rehabilitation services for people with ID vary from nation to nation. Lack of such material makes the findings of this review less generalizable for the ID population across the world. Notwithstanding, our work is unprecedented, to the best of our knowledge, and is the first study attempting to summarize the findings reported in the literature concerning the determinants of MetS in the ID population. We were also able to highlight here a better cognitive outcome of MetS in older ID women in Italy.

7. Conclusions

This study provides insights into certain determinants of MetS in the ID population, which has been a neglected topic, until now, as far as we know. Our hope is that interventions can be planned and implemented with ID populations based on the evidence, as highlighted in this study.

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