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# Abdominal Fat by Imaging Methods and Metabolic Syndrome in Young People

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**Abstract**

Metabolic Syndrome is highlighted in the current health mainly due to its increasing prevalence in the world. Its occurrence among adolescents ranges from 2.2% to 51.7%. This set of diseases, when acquired during childhood/adolescence, tends to persist into adulthood. This study aims to present the results of the latest publications that correlated ultrasonography, computed tomography and magnetic resonance imaging with the components of the Metabolic Syndrome in young people. Nine papers were found. Abdominal adipose accumulation has a strong influence on the metabolic disorders of MS, being measurable by imaging methods. It is of crucial importance to deepen the knowledge of the benefits brought by the imaging tests and their relationship with the components of the syndrome so that clinicians and radiologists can use these exams, especially in young people, where an accurate and early diagnosis allows interventions that will influence reducing the risk unfavorable outcomes in adult life.

**Keywords:** Metabolic syndrome X; Intra-abdominal fat; Computed tomography; Magnetic resonance imaging; Ultrasonography

**Abbreviations:** SM: Metabolic Syndrome; TM: Computer Tomography; RM: Magnetic Resonance Imaging; US: Ultrasonography; BVS: Health Virtual Library; CC: Waist Circumference; IMC: Body Mass Index; GAS: Subcutaneous Abdominal Fat; GAV: Visceral Abdominal Fat

## Introduction

The Metabolic Syndrome (MS) has been gaining attention in the health scenario due to the increase of its prevalence in the world. Among the adolescents its prevalence has wide variation from 2.2% to 51.7% [1], being that its occurrence at this stage tends to persist into adulthood [2]. The central obesity is one of the key components of SM and it has been shown that the association between obesity and cardiovascular risk regarding the fat distribution. Subjects with abdominal obesity have a higher risk than those with gluteofemoral, peripheral or gynecoid obesity [3].

Imaging tests may contribute to the adipose tissue determination and characterization of the influence of the same in the pathophysiology of the syndrome, such as computed tomography (TM), magnetic resonance imaging (RM) and ultrasonography (US) [4-6]. The knowledge deepening on the aspects of the syndrome in young people is crucial, since precisely diagnosed; it enables interventions to reduce the risk of unfavorable outcomes in adult life. This literature review carried out in the databases Medline, through the Publisher Medline (Pubmed), Lilacs and Cochrane through the Health Virtual Library (BVS), with a time limit from 2010 to 2015, aims at evaluating studies that use imaging tests in the identification of metabolic syndrome and its components, with a focus on their employment and capacity for early detection of changes in abdominal fat in adolescents and young adults.

## Results

Among the studies that comprise this literature review, there are five North American production [7-11], two Korean [12,13], an article performed in conjunction between Denmark and Kenya [14] and a Brazilian article(15). Depending on the type of methodology applied in the selected articles, seven studies are cross-sectional and two of them have a methodology of cohort. All in all, the productions totalize 4670 subjects investigated as to associations of Metabolic Syndrome and the accumulation of adipose tissue. The ages mean ranged from 9.1 to 44.5 years.

Among the imaging exams are used to assess the intra-abdominal fat, according to the studies analyzed, four (44.4%) used the TM, four (44.4%) RM and one (11.1%) used the US, being observed correlation of three different types of imaging examinations with the SM. Among those who used RM and TC, three used as anatomical landmark for the

images elaboration, the navel scar (28.30), four studies had as anatomical parameters of the fourth lumbar vertebra (L4) [7,12] or the L4-L5 level [9,10]. An article, by using RM, based its image production based on the highest liver level up to the lower pole of the right kidney [8]. Finally, the study performed with the US [14], was carried out by using the standardized method of Stolk [6], which uses the midpoint between the inferior costal margin and the anterior- superior iliac crest as level for obtaining measurements. For correlation with methods that are more accessible and inexpensive of research, the anthropometric measurements of waist circumference (CC) and body mass index (IMC) were applied to the research obtained by means of the height and total body weight.

## Discussion

The SM early diagnosis can determine actions aimed to prevent the future cardiovascular problems and their secondary psychosocial impairments [15,16]. The use of imaging examinations in the SM diagnosis is still little used in routine investigations. However, studies verified the relation of adipose tissue detected by imaging methods with the measurement of abdominal circumference and IMC. Katzmarzyk [9] points a lower correlation with the cardio metabolic risk, when compared with the CC and Visceral abdominal fat (GAV). According to Ali [7], this index shows a strong correlation with measures of central adiposity, fat distribution, dyslipidemia and insulin resistance.

CC was correlated most strongly with the deposit of subcutaneous abdominal fat (GAS) [7,8,17]. Harrington [8] sought the best anatomical reference for the CC evaluation, compared with the imaging exams, and found that the same does not exist, being suggested using the easiest identification points, avoiding some bone marks in children, due to their detection difficulty in obese individuals and due to its more embarrassing character [18]. There was a higher correlation of GAS with the Metabolic Syndrome during childhood, prevailing a mutual collaboration of GAS and GAV in adolescence, as verified by Spolidoro et al. [17], and transferring this responsibility to GAV in young adults, prevailing in adulthood [15]. The results suggest that the influence of body fat distribution in risk of Metabolic Syndrome is different in children and adolescents compared to adults. The deposit of intra-abdominal fat in adults would be the most significant parameter in terms of influence on insulin resistance and dyslipidemia, whereas in the case of children and adolescents it was identified that the deposit of subcutaneous fat is more related with these factors associated with the Metabolic Syndrome [19].There is still no unanimity in this relation, requiring further studies to determine the diagnosis [7,17,20,21].

It was found only one study using ultrasonography. More studies should evaluate children and adolescents with this imaging test, since it is a useful examination in the direct evaluation of the deposit of abdominal fat, it does not use ionizing radiation and offers lower cost compared with magnetic resonance imaging and computed tomography, being widely accessible and non-invasive. Therefore, this method proves to be advantageous for large population studies and research related to the distribution of abdominal fat.

## Conclusion

This review reveals a significant relation between abdominal fat measures through imaging examinations and the factors of the Metabolic Syndrome, especially the measurement of the thickness of subcutaneous adipose tissue in the lower age groups and the adipose intra-abdominal tissue in adolescents and young adults. Imaging tests have good applicability in the assessment of adipose tissue in young subjects, requiring further studies that adopt the ultrasonography in this evaluation and that can determine the cut-off diagnostics points for MS among children and adolescents, as already raised in adult subjects.

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