



Trabajo Original

Obesidad y síndrome metabólico

The effectiveness of the LA-FINDRISC screening tool in identifying cardiometabolic risk in young female patients with localized breast cancer

Eficacia de la herramienta de tamizaje LA-FINDRISC en la identificación del riesgo cardiometabólico en pacientes jóvenes con cáncer de mama localizado

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Abstract

Background: breast cancer patients present a high prevalence of other chronic diseases and metabolic alterations, including overweight at diagnosis of cancer. This risk also increases after oncology treatment and is a current concern for Latin American countries. Currently, the use of different criteria to identify cardiometabolic risk has been widely applied, considering anthropometric, biochemical and clinical parameters. Additionally, the development of validated screening tools, such as the FINDRISC and LA-FINDRISC, has been considered useful for clinicians to assess metabolic risk in different populations.

Objective: the present study aims to evaluate the effectiveness of the FINDRISC and LA-FINDRISC questionnaires to identify cardiometabolic risk in young women with breast cancer.

Material and methods: a cross-sectional study was conducted to validate the FINDRISC and LA-FINDRISC, including a total of 52 participants.

Results: a sensitivity of 83 % and specificity of 89 % were found for FINDRISC, and a sensitivity of 91 % and specificity of 74 % for LA-FINDRISC to detect alterations in glucose metabolism.

Conclusions: both questionnaires showed lower sensitivity than the international standard criteria for metabolic syndrome, which consider biochemical parameters to assess metabolic alterations. However, these tools and anthropometric measures are useful and easy to apply for clinicians to identify, prevent and treat potential comorbidities associated to cardiometabolic risk in young women with breast cancer.

Keywords: Breast cancer. Cardiometabolic risk. Obesity. FINDRISC. LA-FINDRISC.

Received: 21/01/2025 • Accepted: 20/08/2025

Statements: The authors declare not having conflicts of interest related to this study. Additionally, no financial support or funding was received from any organization or entity for the conduct of this research. The study was carried without external financial influence, and was implemented in accordance with the guidelines of the Institution's Research and Ethics Committee.

Artificial intelligence: The authors declare not to have used artificial intelligence (AI) or any AI-assisted technologies in the elaboration of the article.

Cruz-Ramos M, Becerra-Herrera R, Cabello-Díaz DC, Cabrera Nieto SA, Pérez Camargo DA, Barranco Cortés A, Jiménez Díaz Ceballos Á, Bargalló-Rocha JEJ, Torres-Domínguez JA, Fajardo-Espinoza FS. The effectiveness of the LA-FINDRISC screening tool in identifying cardiometabolic risk in young female patients with localized breast cancer. Nutr Hosp 2025;42(6):1193-1199

DOI: <http://dx.doi.org/10.20960/nh.05701>

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Resumen

Antecedentes: las pacientes con cáncer de mama presentan una alta prevalencia de otras comorbilidades derivadas de alteraciones metabólicas, incluyendo el sobrepeso desde el momento del diagnóstico oncológico. Estas alteraciones pueden acentuarse después del tratamiento oncológico y son una preocupación actual para los países latinoamericanos. En la actualidad, el uso de diferentes criterios para identificar el riesgo cardiometabólico considera parámetros antropométricos, bioquímicos y clínicos. Adicionalmente, el desarrollo de cuestionarios de tamizaje validados, como el FINDRISC y el LA-FINDRISC, se ha considerado útil para el personal de salud en la evaluación del riesgo metabólico en diferentes poblaciones.

Objetivo: el presente estudio tiene como objetivo evaluar la eficacia de los cuestionarios FINDRISC y LA-FINDRISC para identificar el riesgo cardiometabólico en mujeres jóvenes con cáncer de mama.

Material y métodos: se realizó un estudio transversal para la validación del cuestionario FINDRISC y LA-FINDRISC, incluyendo un total de 52 participantes.

Resultados: se encontró una sensibilidad del 83 % y una especificidad del 89 % para FINDRISC, y una sensibilidad del 91 % y una especificidad del 74 % para LA-FINDRISC para detectar alteraciones en el metabolismo de la glucosa.

Conclusiones: ambos cuestionarios mostraron una sensibilidad inferior a la de los criterios internacionales estándar para el síndrome metabólico, que tienen en cuenta parámetros bioquímicos para evaluar las alteraciones metabólicas. Sin embargo, estas herramientas, junto con las medidas antropométricas, son útiles y fáciles de aplicar por el personal de salud para la identificación, prevención y tratamiento de las comorbilidades asociadas al riesgo cardiometabólico en las mujeres jóvenes con cáncer de mama.

Palabras clave:

Cáncer de mama.
Riesgo cardiometabólico.
Obesidad. FINDRISC. LA-FINDRISC.

INTRODUCTION

Breast cancer (BC) is one of the most prevalent cancers worldwide and stands as the leading cause of death from malignant tumors among women. Alarmingly, data indicates that young women in the Latin American population experience significantly higher incidence rates of BC compared to their counterparts in developed nations (1).

A critical concern arises from the diagnosis of BC in the presence of other chronic diseases, including diabetes, overweight, hypertension, or metabolic syndrome, at the time of diagnosis. Oncology treatments may also increase the risk of developing these chronic diseases after BC treatment (2).

In Mexico, approximately 66 % of young women diagnosed with BC (YWBC) are either overweight or obese at the time of their diagnosis (3). Obesity seems directly correlated with larger tumor sizes, poorer differentiation, higher instances of lymph node invasion, and more advanced disease—factors that contribute to a worse prognosis (4). The pro-inflammatory state associated with obesity significantly elevates levels of TNF- α and IL-6, which in turn promotes aromatase production This enzyme catalyzes the formation of estrone and estradiol, both of which fuel breast cancer progression (5). Furthermore, obesity is linked to increased levels of leptin, fibroblasts, T cells, macrophages, and IL-8, while adiponectin—a crucial protective adipokine—decreases, further heightening cancer risk (4).

Alterations in glucose metabolism also play a significant role in BC prognosis. Elevated levels of insulin and IGF-1 are known to promote the onset and proliferation of breast cancer (6). Moreover, various oncology treatments, including immunotherapy and hormonal interventions, can damage pancreatic beta cells, resulting in diminished insulin secretion and disrupted glucose homeostasis (7). Conversely, corticosteroids can exacerbate glucose release while hindering insulin exocytosis. Such metabolic dysregulation leads to an amplified risk profile, significantly increasing the likelihood of developing diabetes *mellitus* (7).

When considering dyslipidemia, it is evident that elevated levels of total cholesterol and triglycerides could promote tumor cell proliferation and angiogenesis (8). While there remains

a lack of conclusive evidence linking hypertension with breast cancer in premenopausal women, it is plausible that a common pathophysiological pathway mediated by adipose tissue drives chronic inflammation—possibly contributing to tumor development alongside low calcium levels associated with hypertension (4).

Endocrine therapy, particularly with the use of tamoxifen, is a cornerstone in treating breast cancer, especially among premenopausal women (9). The influence of hormonal factors, especially estrogenic modulation, on breast cancer is unequivocally established. Tamoxifen is widely recognized for its effectiveness as an anti-estrogen medication; however, it also has the potential to induce dyslipidemia in breast cancer patients. Research demonstrates that patients on tamoxifen for less than a year experience an average weight gain of 7 %, whereas those treated for 36 months or longer can see a dramatic increase of 50 % in body weight (10,11).

Practical screening tools have been developed to identify metabolic syndrome in various populations, addressing the significant impact of metabolic changes on the development of chronic diseases. The criteria set by the International Diabetes Federation (IDF) and the National Cholesterol Education Program Adult Treatment Panel III (NCEP ATP III) are crucial for diagnosis (12,13).

There is a screening tool that predicts the risk of type 2 diabetes in 10 years, one of these is the Finnish Diabetes Risk Score (FINDRISC), which is also able to detect the risk of Mets and abnormal glucose tolerance (AGT) in the general population. This questionnaire considers various metabolic alterations, including elevated waist circumference, physical activity, diet, hyperglycemia, or high blood pressure (14).

To adapt the questionnaire to the Latin American population (LA-FINDRISC), a different score was proposed for waist circumference, this being the only difference between the two questionnaires (15).

According to an Incan study, 27 % of first-time patients have METs, therefore this tool could be useful and easy to apply by clinicians as part of the care for young women with breast cancer, facilitating the timely detection of metabolic alterations that may affect their prognosis (16).

This study aims to evaluate the efficacy of the Finnish diabetes risk score (FINDRISC) and Latin American FINDRISC tool to identify cardiometabolic risk in young female patients with breast cancer in stages I to III.

METHODOLOGY

STUDY DESIGN

A transversal study was designed to identify METs using the routine studies that are requested in the initial consultations in young female patients with BC. Enrollment began in January 2023, after approval by the Anáhuac University Research Committee with the approval record 202178. The sample size was determined for convenience to explore the potential application of this tool by health professionals in these patients during the consultations. The patients were recruited by the Joven & Fuerte Program (3), which is a program dedicated to young women with breast cancer. Patients provided written informed consent for the collection and research use of survey responses and clinical information. The participants' diabetes and METs risk was calculated based on the FINDRISC score and international standard METs criteria.

POPULATION DESCRIPTION

Female patients aged between 18-40 years diagnosed with breast cancer stages I to III, at the Incan. This includes patients receiving multimodal treatment, which may involve surgery, chemotherapy, and/or hormonal therapy, as part of their breast cancer management. All patients were consecutively invited to participate during their first/baseline visit to the oncology department before cancer treatment.

ASSESSMENT OF METABOLIC SYNDROME (METS)

The METs was evaluated according to the international standard following criteria:

National Cholesterol Education Program Adult Treatment Panel III (NCEP ATP III) (13):

- Waist circumference $\geq$ 88 cm in women.
- Hypertriglyceridemia $\geq$ 150 mg/dl.
- Low-HDL cholesterol $<$ 50 mg/dl in women.
- High blood pressure $\geq$ 130/85 mmHg or on antihypertensive medication.
- High FBG $\geq$ 100 mg/dl.

International Federation of Diabetes (IDF) (12):

- Waist circumference $\geq$ 80 cm in women. If BMI is $>$ 30 kg/m², central obesity can be assumed and waist circumference does not need to be measured.
- Hypertriglyceridemia $\geq$ 150 mg/dl.
- Low HDL-cholesterol $<$ 50 mg/dl in women.
- High blood pressure $\geq$ 130/85 mmHg or on antihypertensive medication.
- High FBG $\geq$ 100 mg/dl.

FINDRISC and LA-FINDRISC screening tools

The FINDRISC questionnaire consists of 8 items, which was administered through an interview. It includes age, BMI, family history of diabetes, waist circumference, 30 minutes of physical activity, frequency of fruit and vegetable consumption, history of medication for blood pressure control, and history of elevated glucose levels. Each item is assigned a score ranging from 0 to a maximum of 5 points, depending on the question. At the end of the evaluation, a final score is assigned, the provided scale categorizes risk levels based on a numerical range: between 0-7 is a low risk, 8-11 slightly elevated risk, 12-14 moderate risk, 15-20 high risk and 21 a very high risk of developing type 2 diabetes over 10 years. Subjects with score values in the range 7-12 are offered written information about healthy lifestyle, whereas subjects scoring 14 or above are candidates for further testing for a possible glucose abnormality and are referred for more intensive interventions (14).

Since the FINDRISC and LA-FINDRISC have the same questions, the scores for both were calculated to compare the results (Table I).

Table I. FINDRISC and LA-FINDRISC questionnaires

Category		FINDRISC Score		LA-FINDRISC Score
Age, years	< 45	0		0
	45-54	2		2
	55-64	3		3
	> 64	4		4

(Continues on next page)

Table I (Cont.). FINDRISC and LA-FINDRISC questionnaires

Category		FINDRISC Score		LA-FINDRISC Score
BMI (kg/m ²)	< 25	0		0
	25-30	1		1
	> 30	3		3
Waist circumference	< 80 cm	0	< 90 cm	0
	80-88 cm	3		
	> 88 cm	4	> 90 cm	4
Physical activity (at least 30 min/day)	Yes	0		0
	No	2		2
Daily consumption of vegetables and fruits	Yes	0		0
	No	1		1
Use of blood pressure medication	No	0		0
	Yes	5		5
History of high blood glucose	No	0		0
	Yes	5		5
Family history of diabetes	No	0		0
	Yes, second degree relative	3		3
	Yes, first degree relative	5		5

DATA COLLECTION

The LA-FINDRISC questionnaire was conducted by phone call. Subsequently, the patients' clinical records were taken to obtain anthropometric measurements (weight, height, BMI and waist and hip circumference), laboratory results (FBG and lipid profile) and blood pressure. Both glucose and anthropometric measurements are requested from all patients, but lipid profile is not routinely requested unless there is a suspicion of a metabolic disorder.

The parameters obtained were used to determine whether the criteria for a diagnosis of METs were met. Patients were categorized according to their metabolic risk with the final score in FINDRISC and LA-FINDRISC.

STATISTICAL ANALYSIS

Qualitative analysis of variables is reported as frequencies and percentages; and for quantitative variables, the measures of central tendency and dispersion were calculated (median and ranges). Receiver Operating Characteristics (ROC) curves with their respective areas under the curve and the Youden Index were constructed to show the relationship between the sensitivity and

specificity of the FINDRISC and LA-FINDRISC, for identifying subjects with impaired fasting glucose.

Statistical analyses were performed using SPSS software version 27.0; statistical significance was set at *p* < 0.05.

RESULTS

A total of fifty-two patients were enrolled in the study, mean age was 37 years, weight 65.8 kg, height 159 cm and BMI was 26.5, indicating overweight. Forty percent of the patients have a normal BMI, while 33 % are overweight, 17 % are obese grade 1 and 10 % obese grade 2. An overall count of 46 patients showed waist and hip circumference measurements. The mean waist-to-hip index (WHI) was 0.85. According to the WHO, is considered high (17). In the case of our patients, 83 % have elevated cardiometabolic risk according to the WHI. Regarding fasting blood glucose values, range was 72-130 mg/dl and the mean was 94 mg/dL.

Only 24 patients had lipid profile results available. Of these, the mean values for LDL, HDL and triglycerides were 104.6, 44.5 and 111 mg/dl, respectively.

Patient demographics and clinical characteristics are shown in table II.

Table II. Patient demographics and clinical characteristics

	<i>n</i> (%)	Median	Range
Age	52	37	21-40
Weight (kg)	52	65.8	45.4-98.5
Size (cm)	52	159	142-170
BMI	52		
Normal	21 (40)		
Overweight	17 (33)	26.3	20.7-38.8
Obesity class 1	9 (17)		
Obesity class 2	5 (10)		
Systolic blood pressure (mmHg)	52	115	85-154
Diastolic blood pressure (mmHg)	52	77.5	60-118
Waist (cm)	52	88.5	70-124
Hip (cm)	46	104.5	83-124
WHI	46		
< 0.80	8 (17)	0.85	0.71-1.06
> 0.80	38 (83)		
WHR	52	0.54	0.45-0.75
fat percentage	43	37.6	24.2-45
lean mass index (kg/m ²)	43	16.7	13-20.7
Glucose (mg/dL)	51	94.5	72-130
Cholesterol (mg/dL)	24	175	140-244
LDL (mg/dL)	24	104.6	58.6-149.2
HDL (mg/dL)	24	44.5	26-61
Triglycerides(mg/dL)	24	111	53-428

BMI: body mass index; WHI: waist-hip index; WHR: waist-height ratio.

When both tools were applied, the distributions were found to be similar. We found that 30 patients fell into the low-risk category, indicating that the predominant risk in this population is low.

On the other hand, fewer participants are distributed in higher risk categories, with only 4 or 5 people in the high-risk categories, and no people in the very high-risk category. In the moderate and high-risk categories there were minimal differences, this due to the different cut-off point used for waist circumference (Table III).

To determine the value with the highest sensitivity and specificity to identify impaired fasting glucose with the FINDRISC and LA-FINDRISC instruments, an AUC-ROC was performed.

Among 51 patients, 13 had impaired fasting glucose, representing 25 %. Considering the American Diabetes Association (ADA)

Table III. Risk levels of FINDRISC and LA-FINDRISC

	LA-FINDRISC	FINDRISC
Low risk (0-7 score)	30	30
Slightly high risk (8-11 score)	13	13
Moderate risk (12-14 score)	5	4
High risk (15-20 score)	4	5
Very high risk (> 20 score)	0	0

Data calculated from 52 patients.

criteria for diabetes, 3 patients had fasting plasma glucose values between 100-125 mg/dl and one of them 130 mg/dl. This classifies them as prediabetes and diabetes, respectively. However, other tests such as glycosylated hemoglobin, oral glucose tolerance test or repeat fasting plasma glucose are needed to confirm the diagnosis (18).

Accordingly, the optimal cut-point for detecting impaired fasting glucose was a FINDRISC ≥ 11 and for LA-FINDRISC ≥ 8. For the first one, sensitivity was 83 % and specificity was 89 %. For the LA-FINDRISC, sensitivity was 91 % and specificity 74 % (Table IV).

As for the criteria for METs given by the IDF, of the 24 patients with complete data, 11 patients met the diagnosis (45.8 %). Additionally, there was one patient who did not have a lipid profile, but her blood pressure, glucose, and waist circumference were high enough to meet the diagnostic criteria for MS. According to the NCEP ATP III criteria, 9 patients were diagnosed with metabolic syndrome (36 %).

Table V shows the cut-off points of the 25 patients who had complete data for METs criteria and associated cardiometabolic risk parameters adjusted to glucose tolerance (> 100 mg/dl).

DISCUSSION

LA-FINDRISC is a useful, quick and simple tool that can be applied by any healthcare professional. It can indicate people at increased risk of type 2 diabetes and METs. It has been observed that people with a score of 7 to 14 are offered information on a healthy lifestyle, while subjects with a score of 15 or more are candidates for further testing for a possible glucose abnormality and are referred for more intensive interventions. Applying this questionnaire has relevance because in Mexico there is a 36 % prevalence of METs in the breast cancer population (16).

The potential impact of cancer therapies on the nutritional status and metabolic processes of people undergoing cancer treatment has been reported previously. METs is a group of conditions such as impaired glucose metabolism, overweight and abdominal fat distribution, dyslipidemia, hypertension, and tends to occur in most patients with prediabetes or T2DM (12).

Table IV. The predictive performance of FINDRISC cut-off values for predicting impaired fasting glucose

Glucose (mg/dL)	Score	ROC	Sensitivity	Specificity	Youden index
100-125	FINDRISC > 11	0.90	0.83	0.89	0.660
	LA-FINDRISC > 8	0.85	0.91	0.74	0.660
> 126	FINDRISC > 14	0.89	1.00	0.88	0.880
	LA-FINDRISC > 14	0.91	1.0	0.90	0.900

Data calculated from 52 patients.

Table V. Metabolic syndrome criteria and associated cardiometabolic risk parameters adjusted to glucose tolerance (> 100 mg/dl)

Criteria for cardiometabolic risk diagnosis	AUC	Sensitivity	Specificity	Young Index
Circunferencia de cintura > 80 cm	0.493 (0.227-0.758)	0.625	0.471	0.096
WHI* > 0.8	0.480 (0.236-0.725)	0.875	0.250	0.125
IDF METs criteria YES (≥ 3 criteria from 5)	0.790 (0.600-0.981)	0.875	0.706	0.581
NCEP ATP III METs criteria YES (≥ 3 criteria from 5)	0.695 (0.492-0.928)	0.625	0.765	0.390
LA-FINDRISC Score ≥ 8	0.790 (0.614-0.967)	0.875	0.706	0.581
FINDRISC Score ≥ 11	0.846 (0.690-1.002)	0.750	0.882	0.632

IDF: International Diabetes Federation; METs: metabolic syndrome; WHI: waist-hip index. Data obtained from 25 patients. *Missing hip circumference of one patient.

METs has been associated with the risk of developing breast cancer and this may influence the response to treatment as well as the prognosis of patients. In a study by Dieli-Conwright et al., found that both postmenopausal and premenopausal significantly increased the overall score of METs ($p < 0.01$) and elevated the percentage of body fat, lipid metabolism, glucose metabolism, and inflammation after completing chemotherapy ($p < 0.01$) (19). Findings suggest that chemotherapy may have greater adverse effects on premenopausal breast cancer patients because this group may be induced to experience a transient or permanent early menopause, which promotes a rapid decrease in estradiol levels in the body, leading to weight gain, primarily at the expense of abdominal fat, causing a series of changes in metabolism-related components (20). Also there is a relationship between chemotherapy and weight gain is associated with various factors, including lifestyle changes associated with fatigue, secondary to these treatments, which can lead to a decrease in physical activity (21). The first validation of the LA-FINDRISC questionnaire was carried out in Colombia, in which a sensitivity of 74 % and specificity

of 60 % was obtained with a cut-off point of > 12 points for the detection of diabetes or prediabetes. In addition, several studies have been done in different countries such as Venezuela, Peru, Uruguay, among others (22). Each one of them has obtained a different cut-off point, specificity and sensitivity depending on the population studied, age, sex and the purpose of the screening. In Peru, a cross-sectional LA-FINDRISC study found an area under the curve of 71.5 %, sensitivity of 78.6 % and specificity of 51.7 % in female health care workers for screening of undiagnosed dysglycemia (23). There are few studies using FINDRISC as a screen for METs in countries such as Taiwan, Iran, China and Greece (24). The potential use of the FINDRISC have also been assessed in Mexican population, comparing to the biochemical parameters of METs criteria defined by IDF and NCEP ATP III, finding a lower predictive accuracy for this FINDRISC questionnaire (AUC, 0.634; 95 % CI, 0.604-0.664) (25). On the other hand, anthropometric measures such as the WHI are a useful tool to evaluate the distribution of body fat. In a

study of first-time patients from the National Cancer Institute of Mexico, it was identified that among breast cancer patients, 82 % had an elevated cardiometabolic risk taking a cut-off point of > 0.86 (16). In the present study 38 patients had values ≥ 0.80 , which highlights the importance of measuring this index to identify this risk. Despite the findings of this research, it is necessary to recognize certain limitations. The biggest limitation is that the sample is too small to detect significant differences. Likewise, about half of the sample did not have all the clinical and biochemical data. However, the data obtained from the participants was considered relevant to include in this descriptive study. On the other hand, FINDRISC may not be as accurate in younger people because type 2 diabetes and metabolic syndrome are chronic diseases that occur in older people. According to the Norwegian HUNT study, the prevalence of elevated FINDRISC increased with age and was 17 times higher at 70-79 years compared with 20-39 years of age (26). **CONCLUSION** Screening tools such as LA-FINDRISC may provide additional insights into risk factors for diabetes type 2 and cardiometabolic risk. LA-FINDRISC is an easy-to-use questionnaire that can be administered by any health personnel, is inexpensive and facilitates the implementation of effective interventions to adopt new healthy habits. For METs criteria, anthropometric and biochemical parameters are needed, and they are not always requested in oncology consultations, especially lipid profiles. As for anthropometric measurements, they are easy to measure and only require a tape measure, so we suggest that waist circumference and WHI are parameters that are routinely measured in the consultation. In the present study we found that a score of ≥ 8 for LA-FINDRISC identifies those patients with cardiometabolic risk. Continuous monitoring of weight, waist circumference, blood pressure, fasting glucose and lipid profile is proposed in order to detect alterations in a timely manner and provide adequate treatment.

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