STUDY OF AGREEMENT BETWEEN THE ROSSO-MARDONES AND ATALAH SCALES FOR NUTRITIONAL ASSESSMENT IN PREGNANCY. LA ERMITA CLINIC, CARTAGENA, 2017

Estudio de concordancia entre las escalas de Rosso-Mardones y Atalah para la evaluación nutricional en embarazadas. Clínica La Ermita de Cartagena, 2017

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ABSTRACT

Objective: To assess the degree of concordance between the model for maternal nutritional assessment proposed by Rosso-Mardones and the one proposed by Atalah.

Materials and methods: Diagnostic concordance study. Pregnant women between the ages of 19 and 37 years with a gestational age of 10 or more weeks were included; patients with diabetes, thyroid disease, maternal hypertensive disorder, twin pregnancy, severe fetal malformation, fetal death, and *hydrops fetalis* were excluded. Non-probabilistic sampling. Sociodemographic, obstetrical and nutritional status variables were measured.

Results: Overall, 98 pregnant women were included. With the use of the Rosso-Mardones scale, 33% of the patients were classified as having a normal nutritional status, 22% as low weight, and 44% as overweight or obese. With the Atalah scale, 41% of the women were classified as having a normal nutritional status, 10% as low weight and 48% as overweight or obese. The weighted kappa value was 0.74 with a standard error of 0.04, a 95% CI of 0.66-0.82 and a p value < 0.05.

Conclusions: There is substantial agreement between nutritional assessment scales used in pregnancy, namely the Rosso-Mardones nomogram and the Atalah scale. Further studies to assess concordance of these scales in the pregnant population are required.

Keywords: Prenatal care; nutrition; nutritional assessment; concordance study.

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RESUMEN

Objetivo: evaluar el grado de concordancia entre el modelo de evaluación del estado nutricional materna propuesto por Rosso-Mardones con el propuesto por Atalah.

Materiales y métodos: estudio de concordancia diagnóstica. Se incluyeron gestantes entre los 19 y 37 años, con una edad gestacional de 10 o más semanas; se excluyeron gestantes con: diabetes, enfermedad tiroidea, hipertensión asociada al embarazo, embarazos gemelares, malformaciones fetales graves, muerte fetal e *hidrops fetalis*. Muestreo no probabilístico. Se midieron las variables sociodemográficas, obstétricas y el estado nutricional. Se calculó el valor de kappa de concordancia entre las dos escalas de evaluación nutricional.

Resultados: se incluyeron 98 gestantes. La escala de Rosso-Mardones clasificó al 33 % de las pacientes en estado nutricional normal, al 22 % con bajo peso y al 44% con sobrepeso u obesidad. La escala de Atalah clasificó al 41% de las gestantes en estado nutricional normal, al 10 % con bajo peso y al 48 % con sobrepeso u obesidad. El valor kappa ponderado obtenido fue 0,74 con un error estándar de 0,04 y un IC 95 %: 0,66-0,82 con valor p < 0,05.

Conclusiones: las escalas de evaluación nutricional en gestantes, nomograma de Rosso-Mardones y de Atalah, tienen un acuerdo considerable. Se requieren más estudios que evalúen la concordancia entre estas escalas en población gestante.

Palabras clave: control prenatal; nutrición; evaluación nutricional; estudio de concordancia.

INTRODUCTION

Weight gain during pregnancy is a complex phenomenon influenced by multiple physiological, placental and metabolic factors (1), one of the most important being nutritional status before pregnancy initiation (2, 3).

In the Americas and the Caribbean, the prevalence of overweight and obesity among adult women is around 70% (4) and, according to the Colombian National Nutritional Status Survey (ENSIN, 2010), the prevalence for Colombia was 34% (5). But excess weight and obesity are not the only factors affecting the course of gestation; according to the ENSIN, one out of every five pregnant women, on average,

has some form of nutritional deficit. For example, prevalences of low maternal weight of 18% and 30% have been reported in Colombia for the northeastern department of Casanare (6) and the city Cartagena, in the Caribbean, respectively (7).

Inadequate nutritional status during pregnancy has negative repercussions on fetal, neonatal and maternal health (8-10). Insufficient as well as excessive weight gain during pregnancy are strongly associated with the development of maternal and fetal complications (11, 12). The frequency of premature and low birthweight neonates is higher among low-weight pregnant women as compared to pregnant women of normal weight (9, 10, 13). On the other hand, excessive weight gain gives rise to a higher risk of miscarriage, gestational diabetes, hypertensive disorders, labor disruptions, fetal macrosomia, respiratory distress syndrome, major fetal anomalies and, finally, an increased risk of fetal demise (14).

Consequently, with its advantage of being a modifiable risk factor, weight gain during pregnancy is one of the variables that determines gestational prognosis (15), rendering nutritional assessment of the pregnant woman a critical component of prenatal care (16). Therefore, access to reference guidelines or standards for adequate follow-up of nutritional status throughout pregnancy is required (17).

Several tools are available to clinicians for assessing nutritional status during pregnancy. These include the guidelines proposed by the United States Institute of Medicine (IOM) (18), which are currently the subject of debate because of the weight gain parameters are considered too high for the Latin American population. Another option is the Rosso-Mardones (RM) nomogram proposed in 1997, which identifies women at risk who require nutritional intervention (13, 16). According to the guidelines of the Colombian National Institute of Health (INS), neonates with a birth weight between 2,500 and 2,999 g are classified as weight-deficient, while 3,000 g is classified as normal weight (19).

The RM nomogram has been used to predict that women with low weight at the start of pregnancy are at a higher risk of bearing children weighing < 3.000 g (0.31 sensitivity and 0.8 specificity), while women diagnosed as overweight or obese have a higher risk of bearing neonates with a birth weight > 4.000 g (0.30 sensitivity and 0.77 specificity) (20, 21). The main drawback of the RM scale is that it can only be applied to women 140-175 cm tall and weighing between 30 and 100 kg (22).

Finally, according to Grandi, "the World Health Organization (WHO) has proposed that nutritional assessment in pregnant women be performed using BMI, obtained by dividing weight (kg) by height (m) square" (23); and Espinoza *et al.* point out that "Body mass index (BMI) is an anthropometric way to define fat and lean mass composition in men and women" (16). It was based on this premise that the scale proposed by Atalah (AEA) was developed in 1997, which gives a theoretical definition of the table using the normality criterion proposed by the Food and Agriculture Organization (FAO) (24). However, the AEA proposal also has limitations because, in pregnant women with short legs, BMI does not necessarily correlate with body fat percentage and, during pregnancy, this ratio reflects both maternal as well as fetal weight (2).

Given these limitations of each of the nutritional assessment tools, and also given the fact that there are no known studies in Colombia designed to assess the degree of agreement between both these tools which are widely used in our population, the objective of this study is to assess concordance between the maternal nutritional status assessment model proposed by Atalah and the Rosso-Mardones nomogram in a population of pregnant women in the Caribbean region of Colombia.

MATERIALS AND METHODS

Design and population. A diagnostic concordance study was conducted to assess the degree of agreement between the RM and AEA nomograms used for grading nutritional status in pregnant women. The women enrolled were 19 years of age and older, with a gestational age of 10 or more weeks who attended *Clínica La Ermita* in Cartagena (Colombia) during the period between March and May, 2017. Pregnant women with diabetes, thyroid disease, pregnancy-related hypertensive disorder and *hydrops fetalis* were excluded. This Clinic is a private Level III healthcare facility that serves a population consisting mainly of patients affiliated to the contributive regime of the Colombian General Social Security System. Convenience sampling was carried out from the universe of patients attending the participating institution during the study period. Sample size was not calculated.

Procedure. Potential candidates were identified among pregnant women who presented to the emergency service and were later admitted to the participating institution. Inclusion and exclusion criteria were then applied and the study subjects were selected. One of the investigators explained the study objectives and requested authorization for participation and then proceeded to gather information on sociodemographic and clinical variables. Weight and height were determined using a mechanical Rice Lake scale with a capacity for up to 200 kg and attached size meter. The nutritional status of each patient was determined in accordance with the RM and AEA models. The two components of the RM model, a nomogram and a weight gain graph, are used to calculate weight percentage for height (W/H), based on the woman's weight and height; this value is projected on the percentage found in the nomogram, in relation to the gestational age at which the measurement is made (20). On the other hand, for the AEA calculation, BMI is determined using the patient's weight and height and this value is then related, on the weight gain graph, with the week of gestation on which the measurement is made (24). Nutritional status was determined in both cases.

Measured variables were age, marital status, schooling, parity, gestational age, and weight and size to determine nutritional status, which was classified according to 4 categories: thin or low weight, normal, overweight and obese.

Statistical analysis. A database was created and the Epidat version 4.0 statistical software package was used for data processing. The information is summarized in central trend and scatter for continuous variables according to normality, and in terms of proportions for categorical variables. Frequencies were estimated for nutritional categories, the weighted kappa value for nutritional status of both measurement scales was calculated, and the 95% confidence interval (95% CI) was determined. Nutritional status absolute and relative frequency tables were developed for both scales. Kappa values were interpreted in accordance with the premise proposed in 1977 by Landis and Koch: kappa < 0.00: poor agreement; 0.01-0.20: slight agreement; 0.21-0.40: fair agreement; 0.41-0.60: moderate agreement; 0.61-0.80: substantial agreement; and 0.81-1.00: almost perfect agreement (25).

Ethical considerations. This is a no-risk research pursuant to Resolution 8430 of 1993 of the Colombian Ministry of Health and Social Protection (26) and the Declaration of Helsinki of the World Medical Association (27). The study was approved by the Ethics Committee of the Institution, and data confidentiality was preserved.

RESULTS

During the study period, out of a total of 180 candidates for enrollment, 160 were found to meet the inclusion criteria. Of them, 15 had at least one exclusion criterion. From the remaining 145 candidates, 98 (67%) were selected based on the availability of complete clinical record information.

The mean age of the women enrolled in the study was 26 years, with a range between 19 and 37. Of them, 90 (91.84%) lived in a free union and 6 (6.12%) lived in wedlock. In terms of level

of schooling, secondary education predominated (59.18%), followed by higher education (19.38%), and technical degree (19.38%). Regarding clinical characteristics, 48.98% of the patients were primigravidae, 30.19% were in their second pregnancy, and 20.41% were multiparous (three or more gestations). Mean gestational age was 38 weeks, with a range between 13 and 40. The proportion of women between 13 and 28 weeks of gestation was 6%, 29 and 37 weeks 19%, and 38 weeks or more, 75%.

According to the Rosso-Mardones scale, 33% of the patients had a normal nutritional status, 22% were low weight and 44% were overweight or obese. In relation to the Atalah scale, 41% of the patients had a normal nutritional status, 10% were low weight and 48% were overweight or obese (Table 1).

In terms of the degree of concordance, observed agreement was 0.90 and expected agreement was 0.63; the kappa (weighted) value obtained was 0.74 (95% CI 0,66-0,82; standard error [SE] 0,04), corresponding to substantial agreement of 72% according to the Landis classification (25) (Table 2).

DISCUSSION

This study, conducted in a group of pregnant women in Cartagena, Colombia, found substantial agreement between the AEA, based on BMI, and the RM nomogram, with a kappa value of 0.74 (95% CI: 0,66-0,82). This value is similar to that reported by Benjumea, who found a kappa value of 0.670 (28). Other authors compared the test by assessing sensitivity values (29).

Low weight prevalence was 22% in accordance with the RM curve, as compared to 10% in the AEA. Our results are similar to the 19% low weight on the RM nomogram and 12% on the AEA reported by Mendoza (3); Espinoza and Lara found low weight in 22.5% of the patients in their series with the application of the RM nomogram, compared to 12.94% found with the Atalah model (16). A higher prevalence of low weight was described for the RM

Table 1.
Nutritional status frequencies according to the Ross-Mardones and Atalah scales in pregnant women - Clínica La Ermita, Cartagena, Colombia, 2017

Nutritional status	ROSO-MARDONES		ATALAH	
	Frequency	Percentage	Frequency	Percentage
Low weight	22	22.45	10	10.2
Normal	33	33.67	41	41.84
Overweight	19	19.39	33	33.67
Obese	24	24.49	14	14.29
Totals	**98**	**100.00**	**98**	**100.00**

Table 2.
Contingency table of nutritional status observations applying the Roso-Mardones and Atalah scales in pregnant women, Clínica La Ermita, Cartagena, Colombia, 2017

		Scale 2. Atalah			
		1	2	3	4
Scale 1. Roso- Mardones	1	10	12	0	0
	2	0	29	4	0
	3	0	0	19	0
	4	0	0	11	13
	Total	**10**	**41**		

Kappa: 0.74 (95% CI: 0.66-0.82); SE: 0.04; Substantial agreement: 72 %
1. Low weight; 2. Normal; 3. Overweight; 4. Obesity
Source: Clínica La Ermita de Cartagena archives.

scale by all authors.

In terms of overweight and obesity, observed frequencies were 19.39 and 24.49% with RM, and 33.67 and 14.29% according to AEA. This is consistent with overweight and obesity figures reported by Espinoza and Lara for the RM and AEA scales at 19 and 29.44% and 21.71 and 12.93%, respectively. On the other hand, frequencies of patients with adequate nutritional status are lower on the RM nomogram (33%) than on the AEA (42%), which is also reported by these authors as 36.74 and 44.89% with the RM and AEA

nomograms, respectively (16), but higher than those reported by Mendoza *et al.* at 22 and 28% using the RM and AEA nomograms, respectively (3).

The advantage of the AEA nomogram is that it is the simplest and most useful to assess nutritional status in the clinical environment, and does not need reference populations for its calculation, making comparisons among countries easier (2); however, it is important to recognize that it is just an indirect measurement of stored energy. These two proposals are consistent in guiding a weight gain that is directly proportional to maternal

height and inversely proportional to the nutritional status at the start of pregnancy (30). This could be explained by the fact that the cut-off point on the RM curve between thin and normal is at a higher level throughout pregnancy (15).

This study has some weaknesses. Non-probabilistic sampling means that the results can only be applied to the study population; and there is a high risk of data loss bias due to the percentage of patients who were excluded as a result of incomplete information (33%). As far as strengths are concerned, stringent inclusion and exclusion criteria were implemented, allowing to determine that the observed results are not attributable to underlying medical conditions of the pregnant women. Finally, two scales widely used in clinical practice were assessed and both tools were applied to the same population simultaneously and independently. On the other hand, since the classification is made using both methods, when projecting weight, height and BMI measurements on a tool, the risk of bias is low because of the absence of blinding of the reviewers conducting the second testing of the result of the first test.

CONCLUSIONS

There is substantial agreement between the Rosso-Mardones and the Atalah scales used for the assessment of nutritional status in pregnant women. Further studies to evaluate concordance between these scales in the pregnant population are required.

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AUTHOR'S CONTRIBUTIONS

Edgar Rivas-Perdomo: proposal conception and design, database adjustments, generation and application of data management formulas in the software, data analysis, drafting of the manuscript and final version approval. Martha Galván-Villa: application of the tool for data collection, database arrangement, data analysis, drafting of the manuscript and final version approval.

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