

# Dietary practices in relation to the *Dietary guidelines for the Brazilian population*: associated factors among Brazilian adults, 2018\*

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## Abstract

**Objective:** to describe the adequacy of dietary practices in relation to the *Dietary guidelines for the Brazilian population*, and to analyze associated factors among Brazilian adults. **Methods:** this was a cross-sectional study using a convenience sample of 900 adults (18-60 years old) resident in Brazil; a dietary practices scale (24 items; score 0-72) based on the Guideline recommendations was administered using an online panel; multiple linear regression analysis was used. **Results:** participants' mean age was 33.5 years and 52.0% of them were women; the mean score on the scale was 36.4 points (SD=8.5); scores were directly associated with age (linear trend  $p<0.001$ ), and were higher among people from the North-Northeast regions (37.8), compared to those from the Midwest-Southern regions (35.8) (T-test  $p=0.001$ ). **Conclusion:** the adequacy of dietary practices in keeping with Guideline recommendations was associated with age and region of residence.

**Keywords:** Food Guide; Nutrition Policy; Nutrition Surveys; Cross-Sectional Studies.

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## Introduction

The second edition of the *Dietary guidelines for the Brazilian population*, published in 2014, is widely acknowledged as having been based on a broader healthy eating model, taking into account not only biological aspects, but also the sociocultural and environmental impacts caused by different dietary patterns.<sup>1,2</sup> Another important characteristic of the Guidelines relates to the role of food guides as instruments that can promote the autonomy of individuals and populations in choosing healthy diets.<sup>3</sup> Endorsing this principle, the Brazilian Guidelines contain recommendations that are not quantitative and are presented using language that is accessible to the general population. Rather than referring to number of portions or ideal consumption frequency, the Guidelines use terms such as ‘avoid’, ‘prefer’ or ‘most of the time’.<sup>4</sup>

*Diets containing a higher share of ultra-processed food have poorer nutritional profiles,<sup>7</sup> and that consumption of such food is directly associated with higher prevalence and risk of overweight and obesity in adults<sup>8,9</sup> and adolescents,<sup>10</sup> as well as with the risk of developing hypertension<sup>11</sup> and cancer in general, especially breast cancer.*

The Guidelines’ core recommendations are based on a classification of food items that takes into consideration the extent to which they are submitted to processing and the purpose of this (NOVA classification). These recommendations are summarized in a “Golden Rule”: i.e. choosing fresh or minimally processed foods and culinary preparations instead of ultra-processed foods. Use of the NOVA classification in the document is coherent with Guidelines’ principles, since NOVA enables food to be [...].

A growing number of national and international studies have investigated the impact of food processing on health using the NOVA classification.<sup>6</sup> There is evidence that diets containing a higher share of ultra-processed food have poorer nutritional profiles,<sup>7</sup> and that consumption of such food is directly associated with higher prevalence and risk of overweight and obesity in adults.<sup>8,9</sup>

and adolescents,<sup>10</sup> as well as with the risk of developing hypertension<sup>11</sup> and cancer in general, especially breast cancer.<sup>12</sup> Studies have already demonstrated its association with abdominal obesity and poorer lipid profiles in children.<sup>13</sup> On the contrary, diets based on fresh and minimally processed food have been related to positive health outcomes, such as higher levels of high-density lipoproteins (HDL cholesterol) and lower prevalence of metabolic syndrome, hyperglycemia and overweight.<sup>14,15</sup>

In addition to its recommendations regarding choosing food based on NOVA classification groups, another important theme covered by the Guidelines is the setting in which eating takes place. The time and attention paid to eating, the environment in which eating occurs, distractions, as well as sharing meals and related tasks, are approached in the fourth chapter of the Guidelines. According to the literature, besides interfering with the quantities consumed<sup>16,17</sup> and with the sensation of pleasure provided by food,<sup>4,18</sup> inappropriate eating habits generally favor consumption of ultra-processed food.<sup>10,19</sup>

Evaluation of the Brazilian population’s adherence to the Guideline recommendations is an essential step towards analyzing the impact of this instrument as a public policy intended to promote adequate and healthy eating. According to the United Nations Food and Agriculture Organization (FAO), food guide evaluation has been done in an inadequate manner in many countries, which may represent a weakness and limit knowledge as to the influence of these instruments on the dietary practices of populations.<sup>20</sup> To date, we have found no study having this purpose taking as its reference the current Brazilian Guidelines, possibly owing to the non-quantitative and multidimensional nature of recommendations that require the use of appropriate tools.

In view of this challenge, Gabe & Jaime<sup>21</sup> developed and validated a multidimensional scale that enables measurement of adherence to healthy dietary practices, based on the Guideline recommendations. This scale was adopted by the Ministry of Health for use in the folder entitled ‘How’s your diet?’ (‘Como está sua alimentação?’),<sup>22</sup> used to publicize the Guidelines. Using this instrument, the objectives of this study were to describe the adequacy of dietary practices in relation to the recommendations of the *Dietary guidelines for the Brazilian population* and to analyze associated demographic factors in a sample of Brazilian adults.

## Methods

This was a cross-sectional study using data from a previous study which developed and validated a scale for evaluating dietary practices based on the Guideline recommendations.<sup>21</sup>

The study sample was comprised of 900 adults (18-60 years old) and was a convenience sample, whereby a minimum number of ten observations were extrapolated for each variable of the instrument being validated, in addition to ensuring the participation of Brazilians of differing ages and from different regions of the country.

Data collection took place by means of an online platform produced by a hired company specialized in internet surveys with vast experience in the area and which uses a virtual currency reward system to engage users. Participants were recruited randomly, from a base of 500,000 respondents distributed throughout the Brazilian territory, by means of a smartphone application notification. Participation in the study began when the person accessed the contents of the notification and agreed to participate by giving their Free and Informed Consent.

Following the procedure adopted by the company to ensure data consistency, 5% of users who completed their answers in the shortest space of time ( $n=47$ ), considered to be unreliable answers, were excluded from total replies initially received ( $n=993$ ). Answers given by users who did not meet the age criterion required by the study ( $n=46$ ) were also excluded. The database provided by the company therefore contained 900 answers considered to be consistent and which met the established age criterion.

The scale the users answered covers four dimensions of the Guidelines – planning; household organization; choice of food; eating habits –, represented by a set of 24 items that exemplify dietary practices in line with or contrary to Guideline recommendations (Figure 1). For each item respondents had to indicate whether or not they followed a given practice in their everyday life, by using a four-point Likert agreement scale: strongly disagree; disagree; agree; strongly agree. The score on the scale is calculated by simply adding up the answers to these items (ranging from 0 to 3 points), whereby the total score can vary between 0 and a maximum of 72. In the case of the 13 items in line with the Guideline recommendations (Figure 1A), the highest point is given to the answer showing most agreement (strongly

agree = 3 points); while the points given to the 11 items contrary to the recommendations (Figure 1B) are the opposite (strongly disagree = 3 points). Further details about the development and validation of the instrument can be found in Gabe & Jaime.<sup>21</sup>

For the purpose of classification, cut-off points were developed for use in the ‘How’s your diet?’ folder, taking the same sample used in this study as the reference. Two cut-off points were defined based on point percentiles (P), resulting in three score ranges: <P25 (<32 points); P25-P75 (32-41 points); and >P75 (>41 points). In the folder, which is educational, each range has a message which highlights items to be improved in the diet of those individuals falling into it in relation to the four dimensions of the scale.

Adequacy of dietary practices in relation to Guideline recommendations was assessed according to the total score on the scale and also according to the percentile classification. The score was described by measures of central tendency and dispersion, while percentage classification was described by absolute and relative frequency, for both total sample and sociodemographic characteristic subgroups. Information about socio-economic classification (Brazil Criterion – 2015),<sup>23</sup> age, sex and city of residence were provided by the company hired to do the survey, as this information was held on the record of each user on the platform. The categorical variables were also described by absolute and relative frequency. The ‘age’ variable, in addition to being categorized in age ranges, was also presented in its continuous form, by measures of central tendency and dispersion.

Multiple linear regression analysis was used to verify association between dietary practices and sociodemographic variables. Use of linear regression is justified by the objective of keeping the score in its continuous form, as a dependent variable, thus preserving more information than would be the case in the categorized form. The independent variables were: economic classification (A, B1, B2, C1, C2 and DE); age (categorized into age ranges: 18-29, 30-39 and  $\geq 40$  years); and macro-region – categorized into Midwest-South (includes the Midwest, Southeast and Southern regions) and North-Northeast.

As prerequisites for linear regression analysis, we tested dependent variable adherence to normal distribution (Shapiro-Wilk test,  $p>0.05$ ) and independent variable variance homogeneity (Bartlett test,  $p>0.05$ ).

The 'macro-region' variable was presented grouped together, as in its original form it did not meet the variance homogeneity assumption ( $p=0.002$  in the Bartlett test). Sex, which also did not meet this assumption ( $p=0.031$ ), was used as an adjustment variable. Variables that achieved a statistical significance level of 0.20 in the bivariate analysis were included (by order of significance) and analyzed in the multiple model. A significance limit of  $p<0.05$  was used to keep variables in the final model.

The frequency of the answer categories for each item on the scale was analyzed graphically, based on the visual representation of the pattern of the answers to the scale. All analyses were performed using RStudio 3.4.3 statistical software.<sup>24</sup>

The study project was submitted to the São Paulo University Public Health Faculty Research Ethics Committee (Opinion No. 1.687.651) and approved on April 13<sup>th</sup> 2017. All participants agreed to take part in the study by signing the Free and Informed Consent form

## Results

Mean age of study participants was 33.5 years (standard deviation [SD] = 11.4), 52.2% were women and around half belonged to social classes B2 and C1. There was a higher proportion of individuals from the Southeast region (45.2%), in relation to the other macro-regions (Table 1). The score on the dietary practices scale varied between 4 and 67 points, whereby mean score was 36.4, median score was 36.0 and SD was 8.5. In both its continuous and its categorized form, the dietary practices score was directly associated with age and socio-economic classification, and was higher in the North-Northeast regions. No significant difference was found for sex (Table 1).

Table 2 shows the results of the bivariate and multiple linear regression. Linear trend of dietary practice adequacy in relation to Guideline recommendations was greater as age increased, in both the bivariate and the multiple analysis. A similar result was found according to macro-region: the difference between individuals from the North-Northeast regions and the Midwest-Southern regions also remained in the multiple analysis. With regard to socio-economic classification, a linear trend of falling scores was found, falling from higher classes to lower classes, although this trend was not statistically significant ( $p>0.05$ ) in

the multiple analysis, following adjustment for the 'age' and 'region' variables. As such, the final model included the following variables: 'age' ( $\beta$  30-39 years = 2.35, 95%CI 1.04; 3.63;  $\beta$   $\geq 40$  years = 3.93, 95%CI 2.60; 5.26) and 'region' ( $\beta$  North-Northeast = 2.21, 95%CI 1.04; 3.40), which, when adjusted for sex, accounted for 4.6% of score variance.

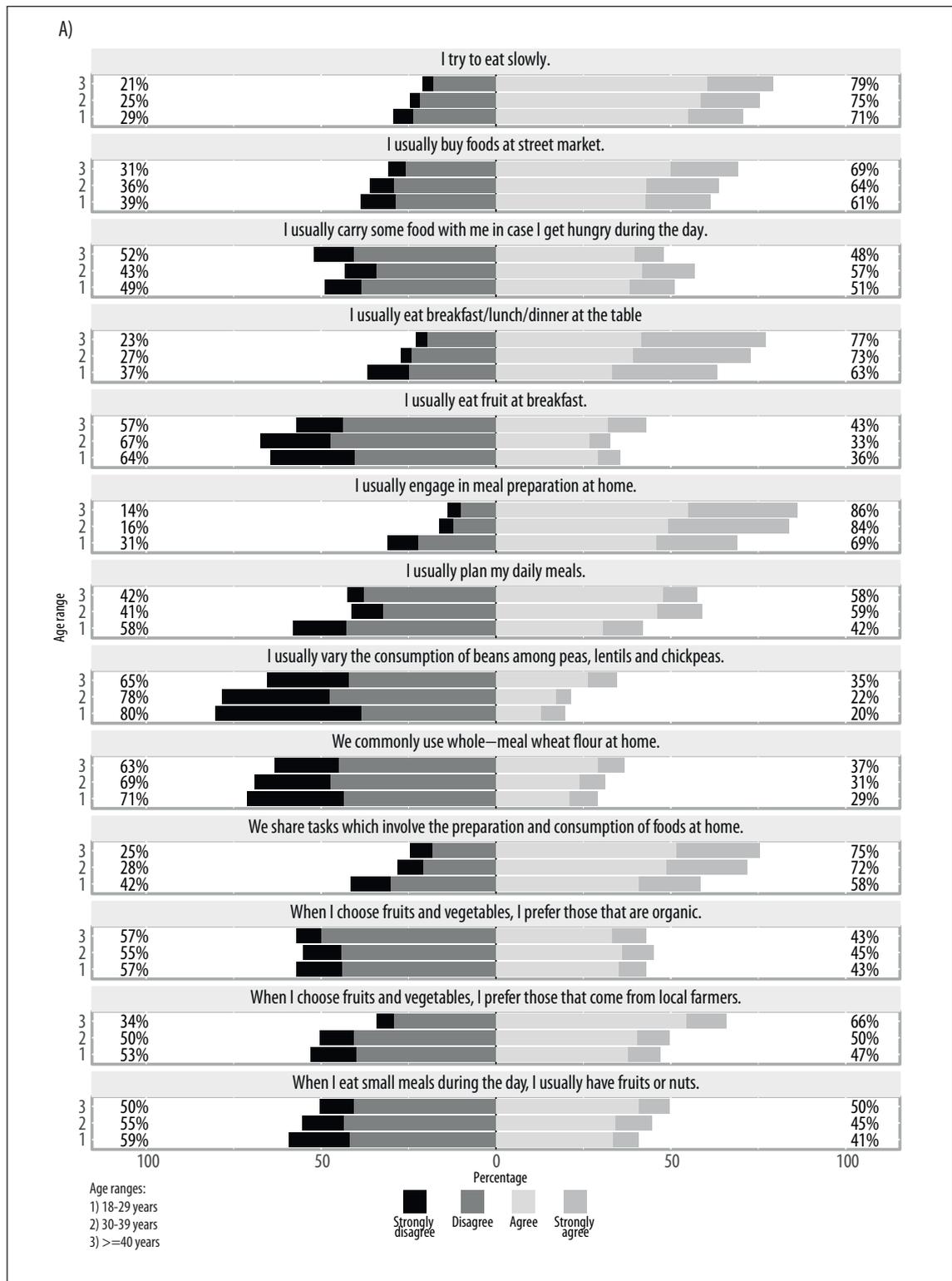
Figure 2 illustrates the proportion of individuals classified in the three score ranges, by age and region subgroups, stratified by sex. Similar score range proportions between men and women can be seen, and this is in keeping with not having observed T test significance for mean differences. With regard to age (Figure 2A), it can be seen that for both sexes the proportion of individuals classified in the higher range (P75;  $>41$  points) increases from the first age range (18-29 years) to the third age range ( $\geq 40$  years). The opposite occurs for the proportion of individuals classified in the lowest range (P25;  $<32$  points). In relation to macro-regions (2B), it can be seen that the highest proportion of individuals in the lowest score range (P25;  $<32$  points) is concentrated in the Midwest-Southern region for both sexes.

Figure 1 shows answer distribution in relation to Guideline recommendations, by age group. In general an increasing trend can be seen in answers agreeing with items that are positive (1A) and disagreeing with items that are negative (1B) over the age ranges, i.e. from the youngest age range to the oldest.

## Discussion

This study describes adequacy of dietary practices in a sample of adults resident in Brazil in relation to the 2<sup>nd</sup> edition of the *Dietary guidelines for the Brazilian population*. In this sample, adequacy in relation to Guideline recommendations was directly associated with age and was greater among individuals living in the North-Northeast regions, when compared to individuals from the Midwest-Southern regions.

The direct relationship between age and dietary quality has been consistently described in the national and international literature. A study conducted in France in 2016 which, like our study, examined the adherence of the country's population to dietary guidelines, found the same linear trend that our study found.<sup>25</sup> In Brazil, the United States and Mexico, studies have found greater consumption of ultra-processed food among younger people.<sup>10,26,27</sup> Similarly, a study based on data from the



to be continue

**Figure 1 – Distribution of answers to the ‘Household organization and ‘Planning’ (A), ‘Choice of food’ and ‘Eating habits’ (B) items of the Dietary guidelines for the Brazilian population, in a sample of Brazilian adults (n=900), by age range, Brazil, 2018**

continuation



Figure 1 – Distribution of answers to the 'Household organization' and 'Planning' (A), 'Choice of food' and 'Eating habits' (B) items of the Dietary guidelines for the Brazilian population, in a sample of Brazilian adults (n=900), by age range, Brazil, 2018

**Table 1 – Score for adequacy in relation to the Dietary guidelines for the Brazilian population in a sample of Brazilian adults (n=900), by sociodemographic variables, Brazil, 2018**

Variables	Sample distribution		Adequacy of dietary practices in relation to the Dietary guidelines for the Brazilian population									
	n	%	Mean	SD	P Value <sup>a</sup>	N	%	n	%	N	%	P Value <sup>b</sup>
<b>Total</b>	<b>900</b>	<b>100.00</b>	<b>36.41</b>	<b>8.53</b>		<b>239</b>	<b>26.56</b>	<b>449</b>	<b>49.89</b>	<b>212</b>	<b>23.56</b>	
<b>Sex</b>					0.958 <sup>c</sup>							0.870
Female	470	52.22	36.43	9.10		123	26.17	233	49.57	114	24.26	
Male	430	47.78	36.40	7.86		116	26.98	216	50.23	98	22.79	
<b>Age range (in years)</b>					<0.001 <sup>d</sup>							<0.001
18-29	400	44.44	34.75	8.16		133	33.25	195	48.75	72	18.00	
30-39	260	28.89	36.10	8.69		66	25.38	127	48.85	67	25.77	
40 and over	240	26.67	38.56	8.42		40	16.67	127	52.92	73	30.42	
<b>Economic class</b>					<0.050 <sup>d</sup>							<0.050
A	88	9.78	37.56	8.74		22	25.00	37	42.05	29	32.95	
B1	107	11.89	38.12	9.43		21	19.63	52	48.60	34	31.78	
B2	239	26.56	36.92	8.59		57	23.85	121	50.63	61	25.52	
C1	216	24.00	35.83	8.50		58	26.85	118	54.63	40	18.52	
C2	131	14.56	35.46	8.04		42	32.06	63	48.09	26	19.85	
DE	119	13.22	35.13	7.66		39	32.77	58	48.74	22	18.49	
<b>Region of origin<sup>e</sup></b>					0.001 <sup>c</sup>							0.005
Midwest-South	618	68.66	35.80	8.45		184	29.77	295	47.73	139	22.49	
North-Northeast	282	31.33	37.80	8.53		55	19.50	154	54.61	73	25.89	

a) P value for scale score difference between groups, in each category.  
 b) P value for difference between proportions in each percentile, according to the Chi-square test.  
 c) P value, according to the unpaired Student's t test.  
 d) Linear trend p value.  
 e) Variable recategorized into North-Northeast and Midwest-South (the latter includes the Midwest, Southeast and Southern regions).

**Table 2 – Association between dietary practice adequacy, according to the Dietary guidelines for the Brazilian population, and 'age', 'region of residence' and 'socio-economic classification' variables in a sample of Brazilian adults (n=900), adjusted for sex, Brazil, 2018**

Variables	Dietary practices adequacy score in relation to the Dietary guidelines for the Brazilian population					
	Bivariate analysis <sup>a</sup>			Multiple analysis <sup>b</sup>		
	$\beta$	95%CI <sup>d</sup>	$\beta$	95%CI <sup>d</sup>	$\beta$	95%CI <sup>d</sup>
<b>Age (in years)</b>						
18-29	Ref		ref		Ref	
30-39	2.40	0.93;3.55	2.35	1.04;3.63	2.00	0.65;3.36
40 and over	3.81	2.46;5.14	3.93	2.60;5.26	3.54	2.14;4.93
<b>Region of residence<sup>e</sup></b>						
Midwest-South	Ref				Ref	
North-Northeast	2.02	0.83;3.22	2.21	1.04;3.40	2.41	0.62;2.41
<b>Economic classification</b>						
A	Ref				Ref	
B1	0.56	-1.83;2.96			0.02	-2.34;2.38
B2	-0.64	-2.72;1.44			-0.89	-2.93;1.15
C1	-1.72	-3.83;0.38			-1.65	-3.72;0.41
C2	-2.10	-4.39;0.20			-2.05	-4.31;0.21
DE	-2.43	-4.78;-0.09			-2.10	-4.48;0.30

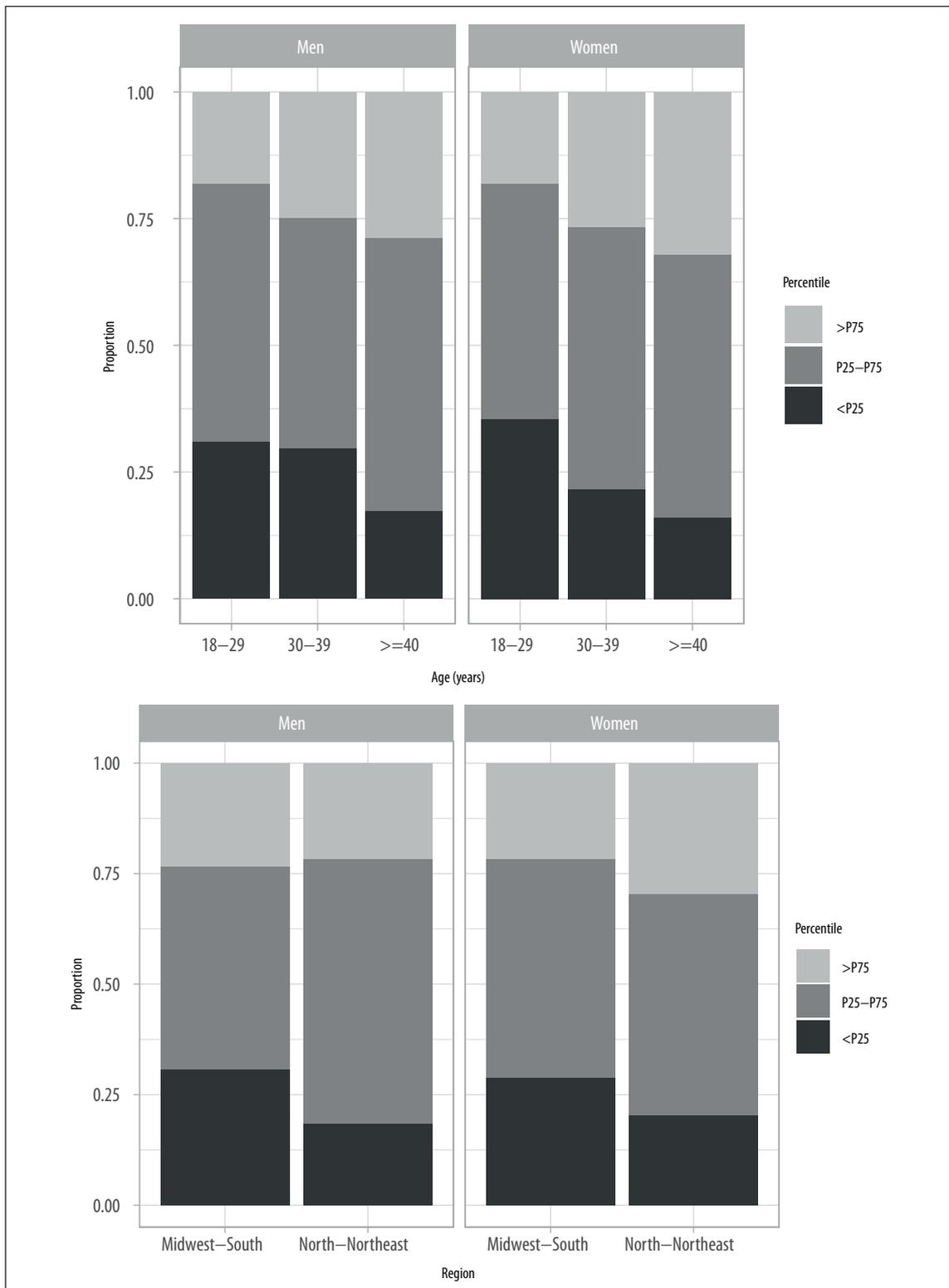
a) Age:  $R^2 = 0.04$ ;  $p < 0.001$  / Region:  $R^2 = 0.01$ ,  $p < 0.001$  / Economic classification:  $R^2 = 0.01$ ,  $p < 0.05$ .

b)  $R^2$  adjusted (age and region) = 0.046;  $p < 0.001$ .

c)  $R^2$  adjusted (age, region and socio-economic classification) = 0.048;  $p < 0.001$ .

d) 95%CI: beta coefficient 95% confidence interval.

e) Variable recategorized into North-Northeast and Midwest-South (the latter includes the Midwest, Southeast and Southern regions).



**Figure 2 – Distribution of participants by dietary practice score percentile according to the *Dietary guidelines for the Brazilian population*, y age range and region subgroups, stratified by sex (men = 430; women = 470), Brazil, 2018**

2013 Brazilian National Health Survey (PNS) found that increasing age was associated with greater prevalence of regular consumption of fruit/vegetables and fish, and lower prevalence of soda pop/artificial fruit juice and sweet food consumption (markers of healthy and unhealthy food consumption, respectively).<sup>28,29</sup>

Corroborating the findings of our study in relation to Brazilian regions, the PNS study mentioned above also identified less prevalent consumption of unhealthy food consumption markers in the North and Northeast regions in relation to the country's other regions.<sup>28</sup> At the time this article was finalized, no studies were found exploring regional differences in food consumption patterns according to NOVA classification.

In addition to food consumption, it is important to highlight that the instrument used in this study includes other dimensions of adequate and healthy diet which, probably, are also related to the results found in this study. According to Garcia,<sup>30</sup> society has undergone transformations that have impacted the population's eating patterns, *which may meet with greater or lesser resistance, depending on dietary culture and the consolidation of its established and symbolically valued practices.*

As such, both age and region of residence may, possibly, modify people's exposure to factors associated with this process.

The results of this study point to the importance of dietary recommendations having multidimensional approaches, such as that adopted by the Brazilian Guidelines. In general, linearity between adequacy in relation to the Guidelines and age is explained much more by the score than by a specific dimension. For example, a similar trend in changes in answer patterns over age ranges was found for 'I usually drink soft drinks'

'I usually eat breakfast/lunch/dinner at the table', 'I try to eat slowly', 'I usually engage in meal preparation at home'. These represent different dimensions on the scale of dietary practices. This emphasizes that interventions aimed at promoting adequate and healthy eating will probably be more effective if they cover the multiple dimensions which, together, result in a healthy dietary practice.

We have presented the sample classified according to ranges of adequacy in relation to the Guidelines, by variable-score distribution percentiles. As this is an objective measurement, this classification may be useful for health service managers in defining intervention targets, or even for individuals to be able to self-assess

their dietary practices, as intended by the 'How's your diet?' folder.<sup>22</sup> However, it is important to take into consideration that the categories were not compared to any criteria external to the study sample. As such the need exists to conduct a convergent and discriminant validation study, as already indicated by Gabe & Jaime.<sup>21</sup>

This was the first study to use and describe the dietary practices scale score in relation to Guideline recommendations, which is why we preferred to use the scale in its continuous form. Using the score has advantages with regard to adherence levels, in that it can detect score changes over time, both individually and collectively. An example of this advantage lies in studies evaluating the impact of Guideline implementation actions, since the continuous variable enables identification of smaller score alterations, even if there is no change in category.

Some limitations should be borne in mind when interpreting these results. The first of them lies in the sample since it was a convenience sample and is therefore not representative of the Brazilian population from the statistical point of view. However, its distribution in terms of age range, socio-economic classification and region of residence suggests that the recruitment system enabled the inclusion of individuals with diverse profiles. Another limitation of the study refers to fact of the database consistency analysis having been conducted by a hired company and not by the researchers, making it impossible to analyze the profile of excluded users or their answer patterns. Moreover, few sociodemographic variables were included in the study since the database, which was created especially for the validation study, only contained those variables. It was not possible to explore variables such as 'level of schooling', 'race/skin color' and 'zone of residence' (rural/urban), and their inclusion is recommended in future studies having a similar objective to this one.

This study stands out for being the first to present data estimating adequacy of dietary practices in relation to the recommendations of the second edition of the *Dietary guidelines for the Brazilian population*. The evidence produced can be useful for orienting the planning of Guideline dissemination actions, either locally or nationally, as well as for informing future studies aimed at evaluating the Guidelines as a public policy. Moreover, the adoption of the scale by the Ministry of Health in the 'How's your diet?' folder,<sup>22</sup> indicates the relevance and the potential of this study as a reference for other future studies using the same instrument.

The results presented demonstrate that the adequacy of adult Brazilian dietary practices in relation to the *Dietary guidelines for the Brazilian population* may be associated with age and region of residence. These findings suggest the need for actions planning the dissemination of the Guideline recommendations targeting young adults and focusing in particular the Midwest, Southeast and Southern regions of the country.

## References

1. Monteiro CA, Cannon G, Moubarac JC, Martins APB, Martins CA, Garzillo J, et al. Dietary guidelines to nourish humanity and the planet in the twenty-first century. A blueprint from Brazil. *Public Health Nutr* [Internet]. 2015 Sep [cited 2020 Jan 9];18(13):2311-22. Available from: <https://www.cambridge.org/core/journals/public-health-nutrition/article/dietary-guidelines-to-nourish-humanity-and-the-planet-in-the-twentyfirst-century-a-blueprint-from-brazil/FDD994F83D72D8620C16C1956D08BB32>. doi: 10.1017/S1368980015002165
2. Ministério da Saúde (BR). Secretaria de Atenção Básica. Departamento de Atenção Básica. Guia alimentar para a população brasileira [Internet]. 2. ed. Brasília: Ministério da Saúde; 2014 [citado 2020 Jan 9]. 156 p. Disponível em: [https://bvsms.saude.gov.br/bvs/publicacoes/guia\\_alimentar\\_populacao\\_brasileira\\_2ed.pdf](https://bvsms.saude.gov.br/bvs/publicacoes/guia_alimentar_populacao_brasileira_2ed.pdf)
3. World Health Organization. Preparation and use of food-based dietary guidelines: report of a joint FAO/WHO consultation [Internet]. Geneva: World Health Organization; 1998. 116 p. (WHO technical report series: 880). Available from: [https://apps.who.int/iris/bitstream/handle/10665/42051/WHO\\_TRS\\_880.pdf;jsessionid=69B6E60D621AE79E8075D246A47686BF?sequence=1](https://apps.who.int/iris/bitstream/handle/10665/42051/WHO_TRS_880.pdf;jsessionid=69B6E60D621AE79E8075D246A47686BF?sequence=1)
4. Oliveira MSS, Amparo-Santos L. Food-based dietary guidelines: a comparative analysis between the Dietary Guidelines for the Brazilian Population 2006 and 2014. *Public Health Nutr* [Internet]. 2018 Jan [cited 2020 Jan 9];21(01):210-7. Available from: <https://www.cambridge.org/core/journals/public-health-nutrition/article/foodbased-dietary-guidelines-a-comparative-analysis-between-the-dietary-guidelines-for-the-brazilian-population-2006-and-2014/DE1E83E39455D360D438DE4130FB1142>. doi: 10.1017/S1368980017000428
5. Monteiro CA, Cannon G, Moubarac JC, Levy RB, Louzada MLC, Jaime PC. The un decade of nutrition, the NOVA food classification and the trouble with ultra-processing. *Public Health Nutr* [Internet]. 2018 Jan [cited 2020 Jan 9];21(1):5-17. Available from: <https://www.cambridge.org/core/journals/public-health-nutrition/article/un-decade-of-nutrition-the-nova-food-classification-and-the-trouble-with-ultraprocessing/2A9776922A28F8F757BDA32C3266AC2A>. doi: 10.1017/S1368980017000234
6. Monteiro CA, Cannon G, Lawrence M, Louzada MLC, Machado PP. Ultra-processed foods, diet quality, and health using the NOVA classification system [Internet]. Rome: Food and Agriculture Organization of the United Nations; 2019 [cited 2020 Jan 9]. 44 p. Available from: <http://www.fao.org/3/ca5644en/ca5644en.pdf>
7. Louzada MLC, Martins APB, Canella DS, Baraldi LG, Levy RB, Claro RM, et al. Ultra-processed foods and the nutritional dietary profile in Brazil. *Rev Saúde Pública* [Internet]. 2015 Jul [cited 2020 Jan 9];49(38):1-11. Available from: <http://www.scielo.br/pdf/rsp/v49/0034-8910-rsp-S0034-89102015049006132.pdf>. doi: 10.1590/S0034-8910.2015049006132
8. Monteiro CA, Moubarac JC, Levy RB, Canella DS, Louzada MLC, Cannon G. Household availability of ultra-processed foods and obesity in nineteen European countries. *Public Health Nutr* [Internet]. 2018 Jan [cited 2020 Jan 9];21(1):18-26. Available from: <https://www.cambridge.org/core/journals/public-health-nutrition/article/household-availability-of-ultraprocessed-foods-and-obesity-in-nineteen-european-countries/D63EF7095E8EFE72BD825AFC2F331149>. doi: 10.1017/S1368980017001379
9. Canhada SL, Luft VC, Giatti L, Duncan BB, Chor D, Fonseca MDJMD, et al. Ultra-processed foods, incident overweight and obesity, and longitudinal changes in weight and waist circumference: the Brazilian longitudinal study of adult health (ELSA-Brasil). *Public Health Nutr* [Internet]. 2019 Oct [cited 2020 Jan 9];1-11. Available from: <https://www.cambridge.org/core/journals/public-health-nutrition/article/ultra-processed-foods-obesity-and-longitudinal-changes-in-weight-and-waist-circumference-the-brazilian-longitudinal-study-of-adult-health-elsa-brasil/0A9776922A28F8F757BDA32C3266AC2A>

## Authors' contributions

Gabe KT and Jaime PC took part in planning the study, data collection and analysis, as well as interpretation of the results. Gabe KT was responsible for writing the manuscript, while Jaime PC critically reviewed it and made adjustments to the text. Both authors approved the final version and are responsible for all aspects of the work.

- nutrition/article/ultraprocessed-foods-incident-overweight-and-obesity-and-longitudinal-changes-in-weight-and-waist-circumference-the-brazilian-longitudinal-study-of-adult-health-elsabrazil/ACB4A2568C14EB5F25FE77000BE4420F. doi: 10.1017/S1368980019002854
10. Louzada MLC, Baraldi LG, Steele EM, Martins APB, Canella DS, Moubarac JC, et al. Consumption of ultra-processed foods and obesity in Brazilian adolescents and adults. *Prev Med* [Internet]. 2015 Dec [cited 2020 Jan 9];81:9–15. Available from: <https://www.sciencedirect.com/science/article/pii/S0091743515002340?via%3Dihub>. doi: 10.1016/j.ypmed.2015.07.018
  11. Mendonça RD, Lopes ACS, Pimenta AM, Gea A, Martinez-Gonzalez MA, Bes-Rastrollo M. Ultra-processed food consumption and the incidence of hypertension in a mediterranean cohort: the seguimiento Universidad de Navarra Project. *Am J Hypertens* [Internet]. 2017 Apr [cited 2020 Jan 9];30(4):358–66. Available from: <https://academic.oup.com/ajh/article/30/4/358/2645510>. doi: 10.1093/ajh/hpw137
  12. Fiolet T, Srour B, Sellem L, Kesse-Guyot E, Allès B, Méjean C, et al. Consumption of ultra-processed foods and cancer risk: results from NutriNet-Santé prospective cohort. *BMJ* [Internet]. 2018 Feb [cited 2020 Jan 9];360(k322). Available from: <https://www.bmj.com/content/360/bmj.k322>. doi: 10.1136/bmj.k322
  13. Rauber F, Campagnolo PDB, Hoffman DJ, Vitolo MR. Consumption of ultra-processed food products and its effects on children's lipid profiles: a longitudinal study. *Nutr Metab Cardiovasc Dis* [Internet]. 2015 Jan [cited 2020 Jan 9];25(1):116–22. Available from: <https://www.ncbi.nlm.nih.gov/pubmed/25240690>. doi: 10.1016/j.numecd.2014.08.001
  14. Nasreddine L, Tamim H, Itani L, Nasrallah MP, Isma'El H, Nakhoul NE, et al. A minimally processed dietary pattern is associated with lower odds of metabolic syndrome among Lebanese adults. *Public Health Nutr* [Internet]. 2018 Jan [cited 2020 Jan 9];21(1):160–71. Available from: <https://www.cambridge.org/core/journals/public-health-nutrition/article/minimally-processed-dietary-pattern-is-associated-with-lower-odds-of-metabolic-syndrome-among-lebanese-adults/213BC6FA992320A444CACADF5296D2C3>. doi: 10.1017/S1368980017002130
  15. Melo ISV, Costa CACB, Santos JVL, Santos AF, Florêncio TMMT, Bueno NB. Consumption of minimally processed food is inversely associated with excess weight in adolescents living in an underdeveloped city. *PLoS One* [Internet]. 2017 Nov [cited 2020 Jan 9];12(11):e0188401. Available from: <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0188401>. doi: 10.1371/journal.pone.0188401
  16. Stroebele N, Castro JM. Effect of ambience on food intake and food choice. *Nutrition* [Internet]. 2004 Sep [cited 2020 Jan 9];20(9):821–38. Available from: <https://www.sciencedirect.com/science/article/abs/pii/S0899900704001510?via%3Dihub>. doi: 10.1016/j.nut.2004.05.012
  17. Cohen DA, Farley TA. Eating as an automatic behavior. *Prev Chronic Dis* [Internet]. 2008 Jan [cited 2020 Jan 9];5(11):A-23. Available from: <http://www.cdc.gov/pcd/issues/2008/jan/>
  18. Scagliusi FB, Rocha Pereira P, Unsain RE, Morais Sato P. Eating at the table, on the couch and in bed: an exploration of different locus of commensality in the discourses of Brazilian working mothers. *Appetite* [Internet]. 2016 Aug [cited 2020 Jan 9];103:80–6. Available from: <https://www.sciencedirect.com/science/article/abs/pii/S0195666316301192?via%3Dihub>. doi: 10.1016/j.appet.2016.03.026
  19. Ludwig DS. Technology, diet, and the burden of chronic disease. *JAMA* [Internet]. 2011 Apr [cited 2020 Jan 9];305(13):1352–3. Available from: <https://jamanetwork.com/journals/jama/article-abstract/896031>. doi: 10.1001/jama.2011.380
  20. Organización de las Naciones Unidas para la Alimentación y la Agricultura. El estado de las guías alimentarias basadas en alimentos en América Latina y el Caribe: 21 años después de la Conferencia Internacional sobre Nutrición [Internet]. Roma: Organización de las Naciones Unidas para la Alimentación y la Agricultura; 2014 [citado 2020 jan 9]. 111 p. Disponible em: <http://www.fao.org/3/a-i3677s.pdf>
  21. Gabe KT, Jaime PC. Development and testing of a scale to evaluate diet according to the recommendations of the Dietary Guidelines for the Brazilian population. *Public Health Nutr* [Internet]. 2019 Apr [cited 2020 Jan 9];22(5):785–96. Available from: <https://www.cambridge.org/core/journals/public-health-nutrition/article/development-and-testing-of-a-scale-to-evaluate-diet-according-to-the-recommendations-of-the-dietary-guidelines-for-the-brazilian-population/E76FDF44ABBD93D969B35CDA19AA3E97>. doi: 10.1017/S1368980018004123
  22. Ministério da Saúde (BR). Como está sua alimentação? [Internet]. Brasília: Ministério da Saúde; 2018 [citado

- 2020 Jan 9]. Available from: [http://189.28.128.100/dab/docs/portaldab/publicacoes/guiadebolso\\_folder.pdf](http://189.28.128.100/dab/docs/portaldab/publicacoes/guiadebolso_folder.pdf)
23. Associação Brasileira de Empresas de Pesquisa. Critério de classificação econômica Brasil [Internet]. São Paulo: Associação Brasileira de Empresas de Pesquisa; 2016. 6 p. Disponível em: <http://www.abep.org/Servicos/Download.aspx?id=12>
  24. R Core Team. R: a language and environment for statistical computing [Internet]. Vienna, Austria: R Foundation for Statistical Computing; 2017 [cited 2020 Jan 9]. Available from: <https://www.r-project.org/>
  25. Lelong H, Blacher J, Menai M, Galan P, Fezeu L, Hercberg S, et al. Association between blood pressure and adherence to french dietary guidelines. *Am J Hypertens* [Internet]. 2016 Aug [cited 2020 Jan 9];29(8):948-58. Available from: <https://academic.oup.com/ajh/article/29/8/948/2622250>. doi: 10.1093/ajh/hpw017
  26. Baraldi LG, Martinez Steele E, Canella DS, Monteiro CA. Consumption of ultra-processed foods and associated sociodemographic factors in the USA between 2007 and 2012: evidence from a nationally representative cross-sectional study. *BMJ Open* [Internet]. 2018 Mar [cited 2020 Jan 9];8(3):e020574. Available from: <https://bmjopen.bmj.com/content/8/3/e020574.long>. doi: 10.1136/bmjopen-2017-02057
  27. Marrón-Ponce JA, Sánchez-Pimienta TG, Louzada MLC, Batis C. Energy contribution of NOVA food groups and sociodemographic determinants of ultra-processed food consumption in the Mexican population. *Public Health Nutr* [Internet]. 2018 Jan [cited 2020 Jan 9];21(1):87-93. Available from: <https://www.cambridge.org/core/journals/public-health-nutrition/article/energy-contribution-of-nova-food-groups-and-sociodemographic-determinants-of-ultraprocessed-food-consumption-in-the-mexican-population/A120C6F14FF2F167B5936F056C081BE2>. doi: 10.1017/S1368980017002129
  28. Claro RM, Santos MAS, Oliveira TP, Pereira CA, Szwarcwald CL, Malta DC. Consumo de alimentos não saudáveis relacionados a doenças crônicas não transmissíveis no Brasil: Pesquisa Nacional de Saúde, 2013. *Epidemiol Serv Saúde* [Internet]. 2015 abr-jun [citado 2020 jan 9];24(2):257-65. Disponível em: <http://www.scielo.br/pdf/ress/v24n2/2237-9622-ress-24-02-00257.pdf>. doi: 10.5123/S1679-49742015000200008
  29. Jaime PC, Stopa SR, Oliveira TP, Vieira ML, Szwarcwald CL, Malta DC. Prevalência e distribuição sociodemográfica de marcadores de alimentação saudável, Pesquisa Nacional de Saúde, Brasil 2013. *Epidemiol Serv Saúde* [Internet]. 2015 abr-jun [citado 2020 jan 9];24(2):267-76. Disponível em: <http://www.scielo.br/pdf/ress/v24n2/2237-9622-ress-24-02-00267.pdf>. doi: 10.5123/S1679-49742015000200009
  30. Garcia RWD. Reflexos da globalização na cultura alimentar: considerações sobre as mudanças na alimentação urbana. *Rev Nutr* [Internet]. 2003 out-dez [citado 2020 jan 9];16(4):483-92. Disponível em: <http://www.scielo.br/pdf/rn/v16n4/a11v16n4.pdf>. doi: 10.1590/S1415-52732003000400011

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