"NOVA Tracker": Statistical validation of the "NOVA Tracker" as an instrument that captures ultra-processed food consumption

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EIn Ecuador, overweight and obesity (ow/ob) reach alarmingly high levels of prevalence in adult and adolescent population. Sedentary habits, loss of dietary diversity and consumption of ultra-processed foods (UPF) are among the identified factors that increase the prevalence of ow/ob, which are part of a phenomenon identified as nutritional transition. The development of the agro-industrial sector, along with the urban lifestyle, contributes to a shift in eating patterns, increasing the risks of chronic non-communicable diseases. This transition occurs when "traditional" diets are replaced with fewer basic foods and greater UPF consumption (1).

These changes in consumption patterns need to be monitored; however, methods employed to date, be it 24 hours or consumption frequency, are costly and their data require long processes for their analysis and interpretation.

Therefore, it is necessary to have a simple, low-cost instrument that allows permanent and periodic monitoring of UPF caloric intake, to obtain timely data to support policy and program decisions that protect healthy eating practices and substantiate the need to adopt healthy food production and supply programs.

In this sense, the objective of the research conducted in Ecuador was to adapt and validate a short food-based filter that estimates the dietary participation of UPF in the population's diet. This instrument is the "NOVA 27 UPF categories Tracker", which was originally designed in Brazil, with 24 categories.

Objectives

The tracker's validation in Ecuador had 2 objectives:

• Standardize the methodology, taking into consideration the various contexts and regions.

• Promote and include this tool in the local statistical agendas from the Health/ Nutrition National Surveys (public or NGO) with the purpose of mapping UPF intake trends over time and facilitate regional comparisons.

Methodology

This tool was designed and validated in Brazil (2) to collect the caloric value of ultra-processed foods. The validation proved to be sufficiently effective to measure the caloric contribution of ultra-processed foods in the Brazilian population's diet.

Due to the potential applicability of the tool, its low cost and the timeliness of the data it provides for decision making, the decision was made to adapt and validate the instrument in Ecuador. The first step was to identify frequently consumed ultra-processed foods and beverages, based on the ENSANUT survey (3). This survey collected consumption data by applying the "24-hour reminder" questionnaire to a population of 19,932 individuals between 6 and 60 years of age.

For this survey, data was collected from a sample of 327 individuals between 18 and 70 years of age, men and women, in which the "NOVA Tracker" and the "24-hour reminder multi-step method" survey were applied. Results of the analysis showed a coincidence in the most consumed food items, at various levels, respecting regional specificities and preserving the items shared between regions.

This information enabled the design of the "NOVA Tracker", with 3 categories and 27 subcategories of ultra-processed products, that is, 3 additional subcategories compared to the tracker designed in Brazil. Categories remained the same as those identified in Brazil, that is, beverages, prepared foods and snacks.

To validate the instrument designed for Ecuador with 27 subcategories, each of the 27 subgroups of ultra-processed products was given a value of 1 if the product had been consumed, totaling 27 if all were consumed. Subsequently, to validate the tracker, the results of its application —in terms of caloric intake of ultra-processed products— were compared to the results of the application of the "24-hour reminder" in adult population over 18 years of age, men and women, in Quito.

To sum up, the methodology analysis for the validation was performed in 3 stages:

i. Adaptation of the list of main UPFs based on ENSANUT 2012 (3).
ii. Data collection for debugging and pairing the composition table with the "24-hour reminder" survey.
iii. Concordance analysis.

Tracker development

Foods and beverages on the "24-hour reminder multi-step method" survey collected in the ENSANUT (3) were classified according to NOVA (4). This list of foods and beverages allowed to filter ultra-processed products into 3 categories and 27 subcategories that records UPF consumption in Ecuador.

As a result, the main items that contribute to the caloric intake of ultra-processed products in adult Ecuadorian population, national average, were identified, as shown in Table 1.

This table shows the average caloric content of the main ultra-processed foods, with a 95% confidence interval at the lower and upper ranges of the calculation. The table also reports the average percentage contributed to the total caloric intake.

Table 1. Main items that contribute to the caloric intake of ultra-processed products in adult Ecuadorian population, national average (3)

Food	Average calories	95% inferior CI	95% upper CI	% cal. cons.
Soda (black, red, yellow)	35.2	29.3	41.1	1.5
Bread (food industry)	42..5	33.6	51.5	1.8
Fruit-flavored beverage (pwd.mix)	14.4	8.4	20.3	0.6
Coffee (instant coffee with sugar)	9.9	6.2	13.6	0.4
Yogurt (with artificial flavors)	6.3	5.2	7.5	0.3
Ice cream (all brands)	4.6	2.8	6.4	0.2
Mortadella (all brands)	4.1	3.2	5.0	0.2
Margarine (all brands)	3.9	3.0	4.8	0.2
French fries with sausage	3.8	2.0	5.6	0.2
Chorizo	3.8	2.4	5.1	0.2
Cacao (powder, all brands)	3.7	3.0	4.3	0.2

UPF scoring was calculated as the sum of the reported UPF subgroups among those 27 listed, with a minimum score of 0 and a maximum score of 27.

It is worth noting that this exercise was possible in Ecuador due to the existence of a national "24-hour reminder" survey. In the absence of sources of ultra-processed food consumption such as the "24-hour reminder" surveys, it is advisable to select the main UPF foods consumed and reported in focus groups or by expert sources (such as Euromonitor) and other secondary data.

"24-hour reminder multi-step method"

The "NOVA Tracker" and the "24-hour reminder multi-step method" survey were applied to the 327 adult subjects over the age of 18, both sexes, in an interview that lasted between 10 and 30 minutes on average, respectively.

The multi-step method allows the respondent to remember numerous times the foods consumed the previous day.

1. Participants inform, quickly and without interruptions, all foods and beverages consumed on the previous day, from the time they wake up until they go to bed.
2. The surveyor inquires about other foods and beverages the interviewee may have forgotten, based on the list of informed products.

3. The participant is then asked about the type, time and place of each meal; followed by details on the form of preparation, origin, amount, home measurements and sizes, as well as adding other foods (for example, sugar).

4. The interviewer lists the entire report to the interviewee, reviewing and promoting that the informer remembers forgotten or omitted products.

The following graph shows the frequencies of scores from the tracker, collected from the sample sorted by ultra-processed subgroup.
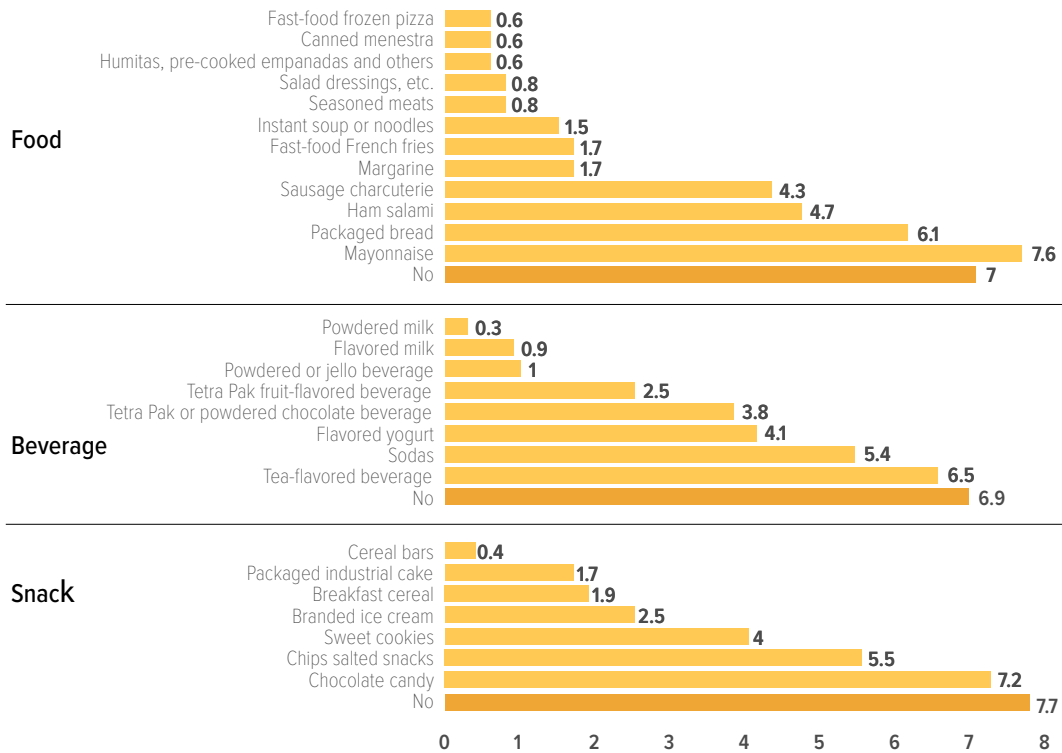
Graph 1. Frequency of tracker responses obtained in the validation phase

Concordance analysis

The distribution of ultra-processed food consumption was calculated according to the quintiles of the contribution of ultra-processed foods to total caloric intake and the approximate quintiles of the tracker score (NOVA) for ultra-processed foods consumption. Distribution comparison was based on the PABAK concordance index, applying a quadratic weight correction to take into account the unbalanced distribution of the categories (5).

Each difference in category was considered uneven in its contribution to agreement, since the difference between the first and second category is considered less important than the difference between the second and third category, and so on, therefore, quadratic weights were used to assess agreement. Concordance reached 0.81 with very good concordance strength.

Table 2. Example of results obtained in the validation phase

Nova sc/ Q %UPF	[0.2)	[2.3)	[3.4)	[4.5)	[5.12]	Total
[min.,Q1)	%	%	%	%	%	%
[Q1,Q2)	%	%	%	%	%	%
[Q2,Q3)	%	%	%	%	%	%
[Q3,Q4)	%	%	%	%	%	%
[Q4,max.)	%	%	%	%	%	%
Total	%	%	%	%	%	%
PABAK.est	PABAK.lower		PABAK.upper		Prop.agree.obs	
Strength_of_ agreement	Low	Reasonable	Moderate		Good	Very good
PABAK	<0.2	0.21-0.40	0.41-0.60		0.61-0.80	0.81-0.40

Thus, the measurement was validated using the tracker, which showed a high level of concordance with the consumption recorded in 24 hours, establishing that the tracker adequately measures the caloric contribution of ultra-processed foods in a qualitative manner.

References

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Analysis code (cran R)

```
# Distribution (%) according to the fifths of the dietary share of ultra-processed foods and
# (approximate) fifths of the Nova score for the consumption of ultra-processed foods.
library(dplyr)
tb <- frame_matrix(~QUPF,~N0_1,~N2_3,~N3_4,~N4_5,~N5_max,
        «min-Q1»,47,30,8,0,1,
        «Q1-Q2»,11,22,16,11,7,
        «Q2-Q3»,5,15,17,11,15,
        «Q3-Q4»,3,6,16,12,28,
        "Q4-max",0,3,11,11,41)
#Función de análisis de concordancia
qpabak <- function(dat,conf.level) {
  q <- ncol(dat)
  weights <- 1 - (abs(outer(1:q, 1:q, "-"))/(q - 1))^2
  n <- sum(dat)
  pa <- sum(weights * dat/n)
  pk. <- (dat %*% rep(1, q))/n
  p.l <- t((t(rep(1, q)) %*% dat)/n)
  pe <- sum(weights * (pk. %*% t(p.l)))
  pabak <- (2*pa)-1
  SD <- sqrt((pa*(1-pa))/((1-pe)^2))
  SE <- SD/sqrt(n)
  CIupper <- (pabak)+(qnorm((1+conf.level)/2)*(SE))
  CIlower <- (pabak)-(qnorm((1+conf.level)/2)*(SE))
  result<- data.frame( pabak.est   = pabak,
              pabak.lower = CIlower,
              pabak.upper = CIupper
  )
  return(result)
}
qpabak(tb,.95)
```