Organoleptic Properties, Ease of Use, and Perceived Health Effects Are Determinants of Acceptability of Micronutrient Supplements among Poor Mexican Women1,2

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Abstract

We assessed the acceptability of 3 micronutrient supplements for pregnant and lactating women: micronutrient powder (Sprinkles), a fortified food (Nutrivida), and tablets. Pregnant or lactating beneficiaries of the Oportunidades program participating in a cluster randomized supplementation trial in urban Mexico were surveyed about the acceptability of 1 of 3 supplements (n = 268). Semistructured interviews (n = 40) were also conducted with a subset of women in the trial and from adjacent rural areas. Acceptability of the supplements was evaluated based on women’s perceptions and experiences with organoleptic qualities, ease of use, and perceived health effects (positive and negative). The median Likert scale ranking of organoleptic and use qualities for all 3 supplements was “I liked it” (2 on a scale of 1–5). However, responses to open-ended survey questions and semistructured interviews indicated decided preferences. Tablets and Sprinkles were strongly preferred over Nutrivida. In interviews, women expressed dislike of the smell, taste, and texture of Nutrivida; they found it cumbersome to store and prepare and reported the most negative effects with it. Between tablets and Sprinkles, tablets were preferred because of the absence of perceptible taste or smell and the simplicity of use. This study provides valuable insights into our currently limited understanding of women’s perceptions and preferences among supplements by broadening the concept of acceptability beyond organoleptic properties. Such an analytical approach is useful for identifying both appropriate nutritional supplements within a given sociocultural context as well as the information that should be included in nutrition education to improve adherence. J. Nutr. 140: 605–611, 2010.

Introduction

There is strong evidence that during pregnancy, women cannot meet a number of micronutrient requirements through dietary sources (1). The sequelae of micronutrient deficiencies during pregnancy and lactation are profound, including abnormal development, lower micronutrient concentrations in breast milk, increased risk of sepsis, and maternal death (2,3).

Targeted micronutrient interventions are usually delivered by tablets, fortified foods, or, more recently, micronutrient powders added to foods (e.g. Sprinkles). Clearly, the effectiveness of such interventions depends upon their acceptance and regular consumption by the target population; a lack of acceptability has been identified as one of the reasons that interventions fail (4–6). Nonetheless, few studies have assessed acceptability, particularly among pregnant or lactating adults. The few such studies have mainly studied sensory characteristics such as taste, texture, and odor (6–8), although some have explored how side effects, regular supplies or lack thereof, the cultural constructs of medicines, and perceived efficacy have affected use (4,9–14). Thus, a determination of acceptability in which a range of the many pertinent domains are assessed is valuable.

The Oportunidades (formerly Progresa) program in Mexico is a conditional cash transfer program designed to increase human capital among the extreme poor by integrated actions in health, nutrition, and education (15). In recognition of the high prevalence of micronutrient deficiency in Mexico and its consequences during gestation and lactation (16), the program provides a fortified, whole milk-based food (Nutrivida) to beneficiary women from their first prenatal visit until 1 y postpartum.

Recently, the appropriateness of Nutrivida as a micronutrient intervention (the stated purpose) has been questioned, in part...
due to its high cost and low consumption by the target population (17). Impact evaluation results from urban and rural areas found that <25% of pregnant and lactating women reported having consumed any supplement in the prior 2 wk; this was unlikely due to supply problems (17). Neufeld et al. (17) also questioned whether it is appropriate to distribute a whole milk-based, sugar-containing food to a population without evidence of energy deficit in adult women (prevalence of BMI < 18.5 under 1%) and a high prevalence of overweight (over 60% in rural and urban areas).

To address these issues, we conducted a cluster randomized trial of 3 supplements to determine whether other, nonenergy-containing micronutrient supplements may be more appropriate based on impact, cost, use, and acceptability (L. M. Neufeld, A. Garcia-Guerra, C. Dominguez, J. Rivera, and A. Hernandez, unpublished data). As part of that trial, we conducted a survey and semistructured interviews about acceptability of the supplements. In this paper, we present data on 3 domains of acceptability: organoleptic (sensory) characteristics, ease of use, and perceived health effects (negative and positive).

Materials and Methods

**Micronutrient supplements.** We tested the acceptability of 3 nutritional supplements: Nutrivida, tablets, and Sprinkles. Nutrivida was donated by the producer (Liconsa). The micronutrient tablets (Zerboni Laboratories) and Sprinkles (Heinz) were developed based on the micronutrient formula of Nutrivida and purchased (Table 1).

Nutrivida is a flavored, fortified, sweetened powder intended to be rehydrated (54 g powder/250 mL water) and consumed as a beverage, similar to a drink common in Mexico (atole). All study participants had received Nutrivida from the program before the study began. Sprinkles were distributed in individual-dose sachets; women were instructed to mix the powder into an appropriate semiliquid food on a daily basis. Women using tablets were instructed to swallow 1 tablet daily with a glass of water. Neither Sprinkles nor tablets had been used previously in the context of Oportunidades, although some women may have had access to iron and/or folic acid tablets from other health providers in the country or through over-the-counter purchase.

### TABLE 1 Nutritional content, portion size, and mode of use of the 3 micronutrient supplements consumed by pregnant and lactating women in the study

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Sprinkles</th>
<th>Tablets</th>
<th>Nutrivida</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy, kJ</td>
<td>1046</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Protein, g</td>
<td>–</td>
<td>12.0</td>
<td>–</td>
</tr>
<tr>
<td>Lipid, g</td>
<td>–</td>
<td>–</td>
<td>11.2</td>
</tr>
<tr>
<td>Carbohydrates, g</td>
<td>–</td>
<td>–</td>
<td>25.3</td>
</tr>
<tr>
<td>Sodium, mg</td>
<td>–</td>
<td>–</td>
<td>81.2</td>
</tr>
<tr>
<td>Iron (ferrous fumarate), mg</td>
<td>15</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>Zinc (gluconate), mg</td>
<td>15</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>Iodine, µg</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Vitamin E (acetate), mg</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Vitamin C, mg</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Vitamin B-12 (cyanocobalamine), µg</td>
<td>2.6</td>
<td>2.6</td>
<td>2.6</td>
</tr>
<tr>
<td>Folic acid, µg</td>
<td>400</td>
<td>400</td>
<td>400</td>
</tr>
<tr>
<td>Portion size</td>
<td>1 g¹</td>
<td>1 tablet²</td>
<td>54 g³</td>
</tr>
</tbody>
</table>

¹ Individual servings in plasticified foil sachets. Instructions are to mix 1 sachet with food daily.

² Hard plastic childproof bottle (30 tablets/bottle). Instructions are to swallow 1 tablet daily.

³ Paper package containing 260 g of supplement. Instructions are to mix 54 g into a glass of clean water daily.

### Cluster-randomized trial.** The cluster-randomized study was carried out from September 2005 to December 2007 to document the impact of the 3 supplements on micronutrient status and weight gain and retention associated with pregnancy. The details of the trial will be published elsewhere. Briefly, 54 small urban communities in 4 states in southern Mexico were randomized to receive Sprinkles, tablets, or Nutrivida, and 13 women were recruited per community (n = 750). All beneficiaries of Oportunidades identified before their 24th week of pregnancy and without severe anemia were eligible to participate. The supplement assigned to the community was delivered daily during the first 9 mo of the trial and weekly thereafter by trained field workers using registries to monitor compliance. Women were followed-up at their 37th wk of pregnancy and at 1 and 3 mo postpartum.

**Survey of acceptability among trial participants (urban areas only).** A survey of acceptability was implemented at the 3-mo postpartum visit. Because funds for the acceptability component were obtained after the main trial was underway, the sample consisted of all women still in the trial at the time of the survey (February to July 2007). The survey included questions about sensory qualities, portion size, packaging, ease of preparation, and perceived health effects (positive and negative) of the supplement that each woman had consumed using a 5-point Likert scale. The questions used in the survey were piloted in a population similar to the study population to ensure adequate comprehension.

**Semistructured interviews about acceptability (urban and rural areas).** To more fully explore acceptability, semistructured interviews were conducted with pregnant and lactating beneficiaries of Oportunidades from 6 communities in the states of Puebla and Veracruz in September and October 2007. We recruited a convenience sample of women who had given birth within the past 3 mo or were currently pregnant (~50% pregnant and ~50% lactating).

Although the randomized trial was conducted in urban communities only, the Oportunidades program extends to both urban and rural regions. To explore differences in the acceptability of the supplements settings, we conducted semistructured interviews with women from urban (n = 20) and rural (~2,500 inhabitants; n = 20) areas. Urban women were interviewed about the supplement that they had consumed as part of the trial as well as about their experiences with Nutrivida.

For the 20 semistructured interviews with rural women, we chose 4 communities close to, but not easily communicated with, urban areas that had participated in the trial. Ten women lived in 2 communities defined as predominantly indigenous [per the definitions of the Mexican Council for Population (18)] and 10 were from 2 nonindigenous communities. Pregnant and lactating beneficiaries of Oportunidades were identified by local program staff and invited to participate after receiving complete details of the study. The design was necessarily different in rural areas, because women there had not participated in the randomized trial. Rural women were randomly assigned to receive a 1-wk supply first of Sprinkles and then tablets or vice versa (thus minimizing bias due to order or consumption) with instructions for their use. At the end of the first week, a field worker visited the home, collected any remaining supplement, inquired about consumption, and provided the women with a 1-wk supply of the other supplement. As in urban areas, all rural women were already familiar with Nutrivida and were thus not asked to consume it as part of this study. At the end of wk 2, women were interviewed about their experiences with all 3 supplements.

All semistructured interviews (duration ~45 min) were conducted at the local health clinic or in participants’ homes by 1 of 7 research assistants (1 male, 6 female) who had received training in ethnographic interviewing. Most women in predominantly indigenous communities were bilingual (Spanish and their local language), but a translator was present to assist when necessary. Participants were recruited until the field supervisor (I.B.) determined that saturation (19) had been reached. Respondents were made anonymous through the use of codes, e.g., (11ENP05).

### Data analysis. Statistical analyses of survey data were conducted with Intercooled Stata 9.2 for Macintosh (StataCorp). Chi-square tests were
used to detect differences between proportions and 2-tailed Student’s *t* tests and ANOVA were used for differences in continuous independent variables from survey data. Data from Likert scale questions were analyzed using the Kruskal-Wallis and chi-square tests, as Likert responses are considered to be ordinal, not nominal (20). Differences in demographic variables were calculated using the SAS software package for Windows 9.1.3 (SAS Institute) based on a general linear model, using generalized estimating equations to consider clusters by community. A *P*-value < 0.05 was considered significant.

All semistructured interviews were transcribed and hand-coded independently by 2 senior research assistants with extensive experience in qualitative research using the methods suggested by Patton and Patton (21). All codes were then grouped into themes in accordance with grounded theory (22,23).

**Ethics.** The proposal for the randomized trial and the acceptability component were reviewed and approved by the Research, Ethics and Biosecurity Commissions of the National Institute of Public Health in Mexico. After appropriate permission from state and local authorities was obtained, information sessions were held to provide general details of the study, eligibility was determined, and written informed consent was obtained on a one-to-one basis for the randomized trial and survey and oral consent for interviews.

**Results**

**Participants**

A total of 268 women participated in the survey, 34.7% of the 750 recruited to the trial and 100% of those still in the study at the time of data collection. More women (*P* < 0.04) who participated in the survey had completed primary education (73.8%) than those who did not participate (65.6%). There were no other significant differences between them. Although there were no differences in the full sample from the randomized trial between supplementation groups, in the subsample, women in the Nutrivida group were older and a greater proportion of them worked outside of the home than women randomized to the other supplements (Table 2).

For the semistructured interviews, 13 women (81% of those invited to participate) were interviewed in urban areas and in rural areas, 28 women (67% of those originally invited to participate) completed the 2 wk of supplementation and interview.

Supplement acceptability data are presented by 3 domains: organoleptic properties, ease of use, and perceived positive and negative effects. We then combined all the information available on these domains from the survey and the ethnographic interviews. Thematic analyses and cross-tabulations of interview responses by sociodemographic characteristics indicated no differences in acceptability between urban and rural women and between nonindigenous and indigenous women in rural areas and thus all results are presented together.

**Acceptability of organoleptic properties**

The Likert scale scores of acceptability of the flavor, odor, texture, or color of the supplements did not differ (Table 3). Furthermore, there was little variability in the responses for any of the characteristics, with the median response for all 4 qualities 2, “I like it,” and ranging from either 1 to 4 or 1 to 5. However, the semistructured interviews and comments made during surveys indicated distinct preferences.

**Flavor.** The fact that Nutrivida had flavoring added was appealing to a few women, but most disliked the taste of it; in semistructured interviews, only 19% of women found the taste to be acceptable. “It seems too sweet... even the plain one tastes like banana, and the banana one is super sweet. Have you tried it?” (11ENP05). Less than one-half (43.8%) of the respondents found the taste of Sprinkles to be acceptable, reflected by such responses as: “it changed the taste of the other foods. It tasted like dust... It disgusted me.” (12ENP04) “The food tasted more salty, like with carbonate” “The taste was unpleasant. I’m telling you, I felt a bitter, bitter taste” (21ENP06). In contrast to Nutrivida and Sprinkles, a large proportion of semistructured interview participants did not find the taste of tablets to be disagreeable (85.7%), mostly commenting that it was tasteless, e.g. “at least for me, they did not have any taste” (12ENP05).

**Odor.** In semistructured interviews, tablets were the most acceptable in terms of odor (94.1%) and Nutrivida was the least (47.8%). “The tablet, it doesn’t have much smell, but the Nutrivida does.” While some women found the smell of Sprinkles unacceptable, “they smelled like vitamins, like old iron” (14ENP08), others found it palatable “Umm... Sprinkles had a smell, but not a bad one, the smell is just like powder” (12ENP03).

**TABLE 3** Acceptability of organoleptic properties as reported by women in surveys at 3 mo postpartum and semistructured interviews during pregnancy or lactation

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Sprinkles</th>
<th>Tablets</th>
<th>Nutrivida</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flavor</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Median Likert score&lt;sup&gt;1&lt;/sup&gt;</td>
<td>43.8 (32)</td>
<td>85.7 (28)</td>
<td>19.0 (21)</td>
</tr>
<tr>
<td>Consider supplement acceptable&lt;sup&gt;2&lt;/sup&gt;, % (n)</td>
<td>75.8 (33)</td>
<td>94.1 (34)</td>
<td>47.8 (23)</td>
</tr>
<tr>
<td>Odor</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Median Likert score&lt;sup&gt;1&lt;/sup&gt;</td>
<td>64.0 (25)</td>
<td>100 (14)</td>
<td>57.1 (7)</td>
</tr>
<tr>
<td>Texture</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Median Likert score&lt;sup&gt;1&lt;/sup&gt;</td>
<td>93.7 (16)</td>
<td>— (0)</td>
<td>— (0)</td>
</tr>
<tr>
<td>Consider supplement acceptable&lt;sup&gt;2&lt;/sup&gt;, % (n)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<sup>1</sup> Data from survey; 5-point Likert scale from 1 “I liked it very much” to 5 “I didn’t like it at all” (Sprinkles, *n* = 81; tablets, *n* = 93; Nutrivida, *n* = 94). Ranges for all Likert responses were 1–4 or 1–5.

<sup>2</sup> Data from semistructured interviews; % is proportion of those who commented who found this aspect of the supplement to be acceptable (Sprinkles, *n* = 35; tablets, *n* = 36; Nutrivida, *n* = 31); *n* = number of women who commented on this aspect of the supplement.
**Texture.** The texture of Nutrivida was acceptable to the smallest proportion (57.1%) of the respondents, frequently because it was perceived as too thick. They reported that it was “like paste” (12LNP01); “I mix it with water but it is very very thick to swallow” (12P05). In contrast, no women objected to the texture of the tablets. Interviewer: “When you put the tablets in your mouth, what did you feel?” Respondent: “Well nothing, I just put them in my mouth, I just wanted to swallow them fast” (12ENP03). The acceptability of the texture of Sprinkles ranked between Nutrivida and tablets; 64.0% of women found it acceptable. Some reported negative sensations: “It felt like little tiny stones [in my food]” (11ENP01).

**Color.** The color of all supplements was acceptable or not an issue to women. In semistructured interviews, no comments were made about the color of tablets or Nutrivida, and only 1 woman found the color of Sprinkles to be unacceptable. “[When I mixed it with the soup] it looked really bad. I did not feel like eating it, that’s why I chose [to eat it with] a banana or anything but liquid and soup” (11ENP05).

**Ease of use**
We established perceptions of ease of use by assessing acceptability of packaging, ease of preparation, portion size, storage, and format of consumption. Although survey data again indicated few significant differences between the acceptability of the ease of use of the 3 supplements, the open-ended survey questions and semistructured interview data indicated a preference for a number of characteristics of Sprinkles and tablets over Nutrivida (Table 4).

**Packaging.** Survey results indicated that the packaging of Sprinkles and tablets were both liked more than the packaging of Nutrivida; this is one of the few characteristics for which Likert data indicated significant preferences.

In semistructured interviews, a greater proportion of women also preferred the packaging of tablets (92.6%) and Sprinkles (92.6%) over Nutrivida (24.0%). This is partially attributed to the fact that both Sprinkles and tablets were so much less bulky than Nutrivida. “I can go to get Sprinkles and I don’t have to take a huge bag. It doesn’t get in my way” (11ENP01). “It is a small sachet which I can bring everywhere” (12ENP03). “Tablets are practical and small, it is not too big like the other” (11LNP07). Another reason for the low acceptability of the packaging of Nutrivida was that the thin paper packaging of Nutrivida was easily chewed through by rodents. In terms of the appearance of any of the supplement labels, only 1 woman commented on it; she found the colors on the Sprinkles label to be appealing (11ENP05).

**Preparation.** All comments in the interviews indicated that Sprinkles and tablets were more convenient to prepare than Nutrivida. “Nutrivida is a little bit more difficult because you have to prepare it, but with the tablets, you just swallow them” (22ENP04). “You have to prepare it. What if you run out of boiled water? Then you can’t take Nutrivida anymore” (22ENP01). Although women did not find the practicality and convenience of Sprinkles or tablets unacceptable, tablets were favored over the Sprinkles. “With the Sprinkles you have to mix it, whereas with the tablets you just take them and that’s it” (11ENP04). “[With tablets] I did not have to worry every day thinking about what I will have with it. I just took the tablets and that was it” (11ENP01).

**Portion size.** In interviews, the portion size of Nutrivida was the least acceptable (60.0%); more women found the portion size of Sprinkles and tablets to be acceptable (96.3 and 85.3%, respectively), although a few women found the tablet size to be too large.

**Ease of storage.** Nearly all women found that Sprinkles and tablets were easy to store (96.7 and 96.4%, respectively), whereas none found the ease of storage of Nutrivida to be acceptable. “It is more convenient the little bottle, with the tablets inside, and it is tightly closed” (13ENP02). Mothers found that Sprinkles “could be stored nearly anywhere, and easily out of the reach of children” (22LNP03). However, for 1 respondent, this small size was a detriment because it was easier to lose (12LNP0). Anecdotal comments indicated that program staff also appreciated the smaller packages, because storage space is an issue in many centers.

**Perceived positive and negative effects of the supplements**
Women spontaneously reported a greater proportion of positive benefits for tablets (n = 15) than Sprinkles (n = 12) or Nutrivida (n = 2) (Table 5). “I felt more energetic” (22LNP05) “I used to be tired, but with the supplement I received... it makes me stronger. I felt like doing things” (12P05). While many women reported benefits of Sprinkles, e.g., “I didn’t feel dizzy anymore” (11P02), nearly the same number reported negative effects, e.g., “I felt sick, so I stopped taking them [Sprinkles]. I felt goose bumps and headache, my throat hurt, and so on. But not with the tablets” (13LNP05). Those who perceived benefits of Nutrivida attributed these benefits to the fact that it was food, e.g., “[When I eat it] the baby gets fat and so doesn’t get sick” (13ENP03). “With this one, I’m
Consequences of the supplements during the interview.

Summary of supplement characteristics that reduced and promoted acceptability by pregnant and lactating women

<table>
<thead>
<tr>
<th>TABLE 6</th>
<th>Characteristics that reduced acceptability</th>
<th>Characteristics that promoted acceptability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supplement</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sprinkles</td>
<td>Organoleptic qualities: Complaints about unpleasant taste and texture; likely due to incorrect preparation</td>
<td>Packaging and storage: Easy to carry, small to store.</td>
</tr>
<tr>
<td></td>
<td>Preparation: difficulties with planning consumption of appropriate foods</td>
<td>Portion size: Quantity in small sachet was easily consumed</td>
</tr>
<tr>
<td></td>
<td>Side effects: Attribution of GI distress to Sprinkles</td>
<td>Positive effects: Energy, strength</td>
</tr>
<tr>
<td>Tablets</td>
<td>Tablet size: Some complaints of difficulty swallowing</td>
<td>Preparation: No preparation made it very easy to take without planning.</td>
</tr>
<tr>
<td></td>
<td>Taste: Some women detected taste or smell of tablets</td>
<td>Packaging size: Small size and tightly closing pill container were appreciated</td>
</tr>
<tr>
<td>Nutrivida</td>
<td>Organoleptic qualities: Complaints about smell, texture, odor and flavor</td>
<td>Positive effects: Energy, strength</td>
</tr>
<tr>
<td></td>
<td>Preparation: Concerns about clean water for preparation; time required to prepare</td>
<td>Flavor: Added flavors [banana, vanilla] were appreciated by a few women</td>
</tr>
<tr>
<td></td>
<td>Portion size: bulky, too filling</td>
<td>Energy: No longer hungry after consumption</td>
</tr>
<tr>
<td></td>
<td>Storage: Space constraints, rodents</td>
<td></td>
</tr>
<tr>
<td></td>
<td>GI distress: Morning sickness made it less tolerable; attribution of GI distress</td>
<td></td>
</tr>
</tbody>
</table>

Overall acceptability

Upon consideration of the organoleptic characteristics, experiences with ease of use, and the perceived health effects, tablets had the greatest number of characteristics that promoted acceptability and the fewest barriers to acceptability (Table 6). Women disliked the smell, taste, and texture of Nutrivida; they found it cumbersome to transport, store, and prepare, and reported the most side effects with it. Sprinkles required more preparation than the tablets and women sometimes struggled to find appropriate foods to mix them with.

Discussion

All 3 supplements included in this study had a number of characteristics that contributed to their greater or lesser acceptability by the women. Overall, Nutrivida was the least acceptable of the 3 supplements studied, and tablets were the most acceptable.

Micronutrient deficiency and anemia are still important public health problems among pregnant and lactating women in Mexico, particularly among the poor and the Oportunidades beneficiary population (24). The original objective of Oportunidades to combat this is still relevant and the randomized trial was conducted in an effort to strengthen the nutrition component of the program and provide insights into whether Nutrivida was the best option to do this.

The relatively greater acceptability of tablets among women in this study may seem surprising given the low compliance with consumption found in other studies (6,9,13) and reported barriers to tablet use, including perceived adverse effects (10,13,25). The intensive contact with project staff in the randomized trial likely explains the higher compliance we found and may also have influenced acceptability. The greater acceptability of tablets was related to their convenience, particularly easy storage, and no preparation. These are aspects that may be less apparent to women who are not comparing them to other types of supplements. The challenge will remain for program designers and implementers to ensure that if tables are distributed, education and promotion is sufficiently convincing. A clear understanding of both how supplements are perceived and the barriers and factors that facilitate their use, combined with education campaigns based on this knowledge, will help to achieve this goal.

It is possible that some of the perceived negative organoleptic qualities of Sprinkles may be explained by improper preparation, i.e. inadequate dissolution in a liquid or solid food. This may have been particularly problematic with the women in rural communities due to brief exposure (1 wk). This is supported by comments from women in urban areas that attest to their trying Sprinkles with a variety of foods.

We saw strikingly little variability in Likert scores. The median Likert scale ranking of all organoleptic and ease-of-use qualities for all 3 supplements was “I liked it” (2 on a scale from 1 to 5), even though responses to open-ended survey questions and semistructured interviews indicated decided preferences. This homogeneity may be explained by reluctance of respondents to give negative evaluations (26) or cultural bias of the Likert format (27,28). In future studies, more illustrative data may be obtained through modification of the phrasing or the content of the Likert questions and the inclusion of more open-ended questions. In this study, we found that semistructured interviews were better suited to capturing the variation in acceptability preferences.
There were some limitations of this study in terms of sample size. It is possible that we were unable to detect differences in rural compared with urban and women from predominantly indigenous and nonindigenous communities for this reason. The survey participants did not differ from the rest of the randomized trial participants for most of the variables studied. Within the survey sample, we have no reason to believe that the older age of women in the Nutrivida group would differentially affect their responses, and the difference, although significant, was not great (only 2–3 y). A greater proportion of women in the Nutrivida group worked outside of the home, which may have presented a limitation to consumption of the study during the initial months of the randomized trial when supplements were delivered daily, although efforts were made to avoid this.

It is worth noting that the cultural context of medicine and food in these communities may have influenced perceptions of acceptability. For example, Nutrivida has been available in Mexico since 1997 and has been heavily promoted in the Oportunidades program at health centers (29). The product was originally developed with knowledge of the nutritional situation in the communities (8) and sensory evaluation showed a high acceptance (30). Tablets may have been more acceptable because they are the oldest delivery method, although there is evidence that they are perceived as less efficacious than syrups or injections in Mexico (e.g. 31). Sprinkles are the most novel delivery mechanism for micronutrients; research among U.S. children indicated caretakers were concerned about their novelty and safety (32). We do not know if their relative novelty increased or reduced their acceptability in this study. Interestingly, in a parallel study of supplements conducted among Mexican children, Sprinkles were highly acceptable for children, much more so than micronutrient syrup (33). This would suggest that novelty per se may not reduce acceptability. Based on the interview results for both studies, we think that this may also be related to issues of time and convenience; women may be more willing to invest the time for their children than for themselves. An understanding of the cultural context and perceptions of food and medicine and the incorporation of this into supplement selection and education would likely be useful to improve compliance.

This study has provided information useful for policy in the Oportunidades program in Mexico, but it also has implications beyond the Mexican context. We have demonstrated that insights into acceptability can be gained by broadening the concept beyond the domain of organoleptic appeal. This analytical approach is useful for identifying both appropriate nutritional supplements within a given sociocultural context as well as the type of information that should be included in nutrition education to improve acceptability and compliance in a program context.

Clearly, to be effective in reducing micronutrient malnutrition in populations, micronutrient supplements must be regularly consumed by a large proportion of the intended target population. Although selecting an acceptable supplement is not enough to ensure regular consumption in a program context, a clear understanding of why supplements are or are not acceptable and the barriers and factors that facilitate their regular use and the incorporation of this information into education campaigns could make them more convincing and ultimately improve compliance. Until we understand and apply this in programs, we run the risk of condemning all new (and old) micronutrient supplements to a life on the shelf.

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Literature Cited