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Characterizing the behaviour towards traditional foods of school children in Guasaganda, Cotopaxi-Ecuador

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Abstract*– Healthy eating behaviours are of particular interest to nutrition education. In Ecuador, children in rural areas are the main concern because they carry a higher burden of malnutrition compared to urban areas. In this study, we grouped rural children according to their attitudes, social influences, and self-efficacy in terms of latent variables, using school type as a concomitant variable to predict latent class membership. The study included rural children studying in 3 different schools involving thereby a) all students from 2nd till 5th grade in a single classroom setting who are taught by only one teacher (n=12), b) students of one 3rd grade in a conventional school (n=29), c) students of two 3rd grade courses in a Millennium School (n=38). We estimate that children learning in traditional schools with less modern infrastructure (school A and B) have a high probability of having low self-efficacy to traditional foods (TFs) and are more oriented to follow parental norms when eating TFs. The low self-efficacy to TFs of these children could possibly be explained by the low quality of education received in these schools. These conclusions could be used to implement future interventions to promote the consumption of TFs and fight malnutrition among children living of Guasaganda.

***Keywords*-- Eating culture; indigenous children; biodiversity; traditional diet.**

I. Introduction

Addressing malnutrition by promoting the consumption of traditional foods (TFs) which are produced using sustainable agricultural practices is a major challenge for many developing countries [1]. In Ecuador, national efforts are trying to reduce the double burden of wasting (too thin for his or her height) and overweight (too heavy for his or her age) in children through promoting healthy eating practices [2]. Paradoxically, school children in rural areas (5 to 11 years old) have a higher prevalence of malnutrition despite the food is locally produced, compared to urban areas where malnutrition is less prevalent, being indigenous children in the highlands the most vulnerable [3]. To illustrate, in the highlands 27 % of rural children are shorter for their age and 26% are overweight whereas 15% and 32 % is the prevalence in urban areas, with figures under the 10% for stunting and 20% for overweight in Afro-Ecuadorian and Amazon regions (ibid). The consumption of TFs contributes to micro-and macronutrient intake in Ecuadorian rural areas [4], and might be the key to fight malnutrition. However, there are several individual (i.e., knowledge, attitudes) and environmental (i.e social norms, seasonality) barriers to eating TFs among indigenous children in rural Ecuador that limits their consumption [5]. Therefore, nutrition education that supports the consumption of TFs is highly recommended.

TFs include several species whose production was neglected by the conventional food production system that boosted only a few commercial crops as a result of the green revolution. Despite TFs are not commodities these are key in keeping cultural identity, traditional knowledge, rituals and fighting malnutrition. The food production system that involves TFs is mainly driven by indigenous people who safeguard the genetic pool of varieties within species, which are important elements of food security during resilient times [6]. However, food consumption in rural children has been reported to be transitioning from the consumption of TFs to industrialized foods. For example, children in Guasaganda, a town located in the province of Cotopaxi in Ecuador, used to drink fresh milk and eat boiled plantains for breakfast but currently many of them drink milk in tetrapack and eat plantain chips. Changing the existing negative perceptions about TFs (i.e., that TFs are food for the poor) is a challenge that requires urgent action [7], particularly among children who are acquiring eating patterns that would linger into adulthood.

It is known that children's behaviours differ according to their individual perceptions and environment [8]. More specifically, rural and urban children's behaviour towards TFs varies in terms of perceptions, parental modelling and auto-control, as explained by the so-called Attitude, Social Influences and Self-Efficacy (ASE) theory [9]. The latter

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theory studies behaviour at multiple levels, conceptualizing that eating behaviour is influenced by each of the latter three constructs [10]. Indigenous children have shown positive perceptions about TFs including their nutrient content, taste and cultural significance [11]. Also, they have shown to feel susceptible to dietary related health problems when not eating TFs, and therefore parental rules should promote the consumption of TFs and limit the consumption of processed foods. Self-efficacy for indigenous children has been shown to be associated with their ability to preparing their own meals (ibid). More importantly, the availability of TFs is a necessary condition for consuming TFs, particularly in biodiverse-rich environments. TFs are mainly produced within a traditional food production system where Andean roots, cereals and tubers are the key crops. In this line, indigenous children of Guasaganda have identified the loss of biodiversity as a barrier to eating TFs.

In this study, we analyzed children from three public-rural schools in different settings, located in Guasaganda, Cotopaxi – Ecuador. The objective of the study was to group the children using latent classes in each of the attitudes, social influences, and self-efficacy constructs in order to characterize the behaviour of these children towards TFs. We also investigated differences among the included schools with regard to the latent classes in each construct. This was made on the basis of interviews that were carried out after lecturing the children about TFs using a pre-designed booklet. The booklet illustrated the children about TFs.

2. Materials and Methods

A booklet (Figure 1) was designed for school children to make them aware about TFs which later enabled the interviewers to ask questions about their eating behaviour. The booklet considered 31 edible plant species and 8 animal species. The inclusion of foods into the booklet was based on the results from focus groups interviews of a previous study in the same area where children listed all TFs that they know and have consumed [5]. The full booklet can be downloaded at: https://doi.org/10.6084/m9.figshare.14403437.v1

The study area is located in central Ecuador between 800 and 1,000 meters above sea level and therefore it is a biodiversity spot with a high number of local plants, and animal biodiversity [12]. Guasaganda has 5000 inhabitants who speak Spanish and Quechua and are mainly dedicated to agriculture and animal husbandry. Guasaganda is located in the province of Cotopaxi (Figure 2) and has a temperate climate. The inhabitants of Guasaganda are mainly indigenous with Andean culture and a minority are people who migrate from the coastal regions. Because of the temperate climate, local people can have access to both Andean and Coastal foods.

We included 3 different school settings in the study, all being public-rural schools located in Guasaganda, Cotopaxi – Ecuador. The schools were selected by convenience sampling, the criteria were that these were accessible within walking distance of 30 min from the central village and accepted to participate in the study. From the five primary schools in the area, we selected the only three that complied with the inclusion criteria. Thereafter, interviews were conducted with i) all students in a single united school (n=12), ii) students of one 3rd grade in a conventional school (n=29), iii) students of two 3rd grade courses in a Millennium School (n=38), coded in this study as school A, B, and C, respectively (See Figure 2).

Fig. 1 Booklet used for interviews to characterize children´s behaviour towards traditional foods in Guasaganda- Ecuador. Page 1-8 (from left to right, from the first row to the second row).

The designed booklet was presented in each school to students during school hours the first week after returning from September break. Two trained nutrition educators (DP and SB) explained, in each school, the content of the booklet (page-by-page) in a 15-minutes lecture followed by 5 minutes dedicated to answering children's questions.

At the beginning of the lecture, the first pages (page 1 and 2) of the booklet were used to break the ice and to present the main character of the booklet, Chullo, to the children, including his ethnicity, family members and peers. Then, the educational content covered the following chapters: i) local foods ("alimentos locales"), including fruits and vegetables, grains and starchy foods, meats, milk products, aromatic beverages (page 3 and 4); ii) my plate ("mi platito"), which is the adaptation of my plate version composed of TFs (page 5);

and iii) habits (“hábitos”), covering three levels of influences i.e., individual, family and school settings (page 6 and 7).

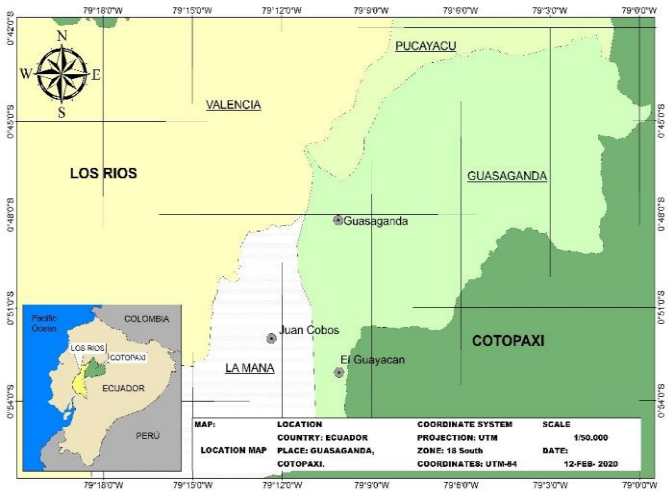

Fig. 2 Study area and the location of the three schools involved in the study. School A is located in Juan Cobos, school B is located in El Guayacan and school C is located in Guasaganda.

The content of the booklet was lectured equally at the three schools. The lectures at school A, B and C used the printed version of the booklet. Immediately after lecturing the children using the booklet, each student was interviewed by a trained interviewer with knowledge on eating behaviour and TFs (SB). The interview used questions on each construct of the ASE theory. The questions for each construct were adapted from a previous study on highland children [9], and then pilot tested. Attitudes towards TFs, vegetables, and fruits were assessed by asking their view about the foods presented on page 4. Self-efficacy was evaluated by asking the children about their ability to choose between healthy meals with TFs or unhealthy meals as presented on pages 5 (my plate tool) and 7 (food choice when eating alone). Social influences were assessed using page 7 (eating with friends and family) and asking if they ate TFs recommended by their grandparents (page 8).

We identified and characterized clusters of students for each construct. The basic idea was to probabilistically group each student into a class by means of an unobserved latent nominal variable [13–15]. For this, we used a latent class regression model [16, 17]. This latent class model assumes that the multi-way cross-classification table of observed (or, “manifest”) variables can be modelled by a finite mixture of constituent multi-way cross-classification tables with all variables mutually independent. Under this model, the number of component distributions is equal to the number of latent classes that characterize the multivariate categorical data. This latent class regression model further assumes that the latent class prior probabilities vary by individual as a function of some set of independent (or, “concomitant”) variables. We, therefore, used school as a concomitant variable to further help predict latent class membership and to investigate differences among the three schools with regard to the latent classes.

3. Results

Table 1 shows the demographic characteristics of the studied group. For the attitude construct, we fitted a latent regression model with 2 latent classes, which was the most parsimonious model with the lowest BIC value and Pearson’s χ^2 statistic. The estimation algorithm was run 30 times to reach a good solution that approximates the global maximum of the log-likelihood function. The class conditional outcome probabilities estimated by this model are shown in Table 2 for the attitude construct.

TABLE I
DESCRIPTIVE STATISTICS OF THE STUDIED CHILDREN

Variable	Location (CODE)	Frequency	Valid Percent
School			
Copal Chile	Juan Cobos (A)*	12	15.19
Guayacan	Guayacan (B)**	29	36.71
Millenium	Guasaganda (C)***	38	48.10
Gender			
Male		35	55.62
Female		44	44.30

*United schools are composed by children from 2nd till 5th grade in a single classroom who are guided by only one teacher. **Conventional schools have students organized by age groups in each classroom with a teacher for each grade according to age group. ***Millennium schools are public schools created by the government with modern infrastructure and has one teacher for each grade according to age groups.

Latent class 1 is estimated to represent 24.7% of the population of study while latent class 2 is estimated to represent 75.3% of that population. As we can see from Table 2, students belonging to latent class 2 for the attitude construct are children that recognize on average more fruits and vegetables in their plates and have a more positive attitude towards TFs compared to children belonging to class 1. Therefore, the majority of students in our population may have a positive attitude towards TFs. In addition, we conclude that school is not a statistically significant predictor of the latent class membership in this construct (p=0.149) at the 5% significance level.

For the self-efficacy construct, we also selected a model with 2 latent classes since it was the most parsimonious model with the lowest BIC value and Pearson’s χ^2 statistic value. The estimation algorithm was also run 30 times here in order to try to approximate the global solution of the log-likelihood function. As a result, we obtained the class conditional outcome probabilities shown in Table 3 for the self-efficacy construct.

Latent class 1 can therefore be seen as the class of students with high self-efficacy that choose with high

probability traditional drinks, healthy foods, vegetables, fruits, and foods rich in proteins and carbohydrates, as opposed to students belonging to class 2 who make these choices with lower probabilities (see Table 3). The model estimates that 48.97% of the population belongs to the high self-efficacy class while 51.03% of the population belongs to the low-self efficacy class. In addition, we found in this construct that the school where the student belongs is a statistically significant predictor of latent class membership ($p<0.0001$) at the 5% significance level.

TABLE II
ESTIMATED CLASS CONDITIONAL OUTCOME PROBABILITIES FOR THE ATTITUDE CONSTRUCT.

Manifest Variables	CLASS 1			CLASS 2		
Attitude to TFs*	Positive 74.63%	Negative 0.00%	Indifferent 25.37%	Positive 96.56%	Negative 1.68%	Indifferent 1.76%
Attitude to vegetables**	Recognize 3-5 0.00%	Recognize 1-2 60.98%	Do not recognize any 39.02%	Recognize 3-5 38.67%	Recognize 1-2 47.24%	Do not recognize any 14.10%
Attitude to fruits***	Recognize 3-5 0.00%	Recognize 1-2 100.00%	Do not recognize any 0.00%	Recognize 3-5 80.69%	Recognize 1-2 17.62%	Do not recognize any 1.68%

Attitudes were evaluated by using the questions: *How do you feel about the TFs shown in this page (page 4)? **How many vegetables do you recognize from page (page 4)? *** How many fruits do you recognize from page (page 4)?.

Figure 3 shows the predicted prior probabilities of latent class membership for each of the three schools analyzed for the self-efficacy construct. These prior probabilities are probabilities of latent class membership before taking into account the responses to the self-efficacy "manifest" variables (see Table 3). Students from school C have a 100% prior probability of belonging to the high self-efficacy class. In contrast, students from school A and students from school B both have a very high probability of belonging to the low self-efficacy class.

For the social influences construct, a latent model with 2 latent classes was also selected based on the BIC and the χ^2 statistic criteria. The estimated class conditional outcome probabilities are shown in Table 4 for the social influences construct. As can be seen from Table 4, latent class 2 represents students with higher influence from their family while latent class 1 represents students with higher influence from their friends. The class more oriented towards the family is estimated to represent 77.70% of the population, while the class more oriented towards friends is estimated to represent 22.30% of the population. In this construct, we found that school is a statistically significant predictor of latent class membership ($p<0.0001$) at the 5% significance level.

TABLE III
ESTIMATED CLASS CONDITIONAL OUTCOME PROBABILITIES FOR THE SELF-EFFICACY CONSTRUCT

Manifest variables	CLASS 1			CLASS 2		
Self-efficacy traditional drinks*	Yes 100.00%	No 0.00%		Yes 80.15%	No 19.85%	
Self-efficacy Carbohydrates**	Yes 100.00%	No 0.00%		Yes 67.75%	No 32.25%	
Self-efficacy Protein***	Yes 100.00%	No 0.00%		Yes 70.23%	No 29.77%	
Self-efficacy Fruits & Vegetables****	Eat 1-2 F&V 100.00%	Eat 3-4 F&V 0.00%	Do not eat 0.00%	Eat 1-2 F&V 65.27%	Eat 3-4 F&V 27.29%	Do not eat 7.44%
Self-efficacy eating healthy when alone +	Healthy 97.33%	Not healthy 2.67%		Healthy 77.76%	Not healthy 22.24%	

Self-efficacy was evaluated by using the questions: *Would you choose drinking a traditional drink like the one shown on this plate (page 5)? **Would you choose eating traditional carbohydrates like the one shown in this plate (page5)? ***Would you choose eating traditional chicken, fish or pork in this plate (page 5)? ****Would you eat only 1 or 2 fruits and vegetables in your meal, 3 or 4 or none? + When being alone, would you choose to eat healthy (as shown in page 7, right panel) or unhealthy (as shown in page 7, left panel)?

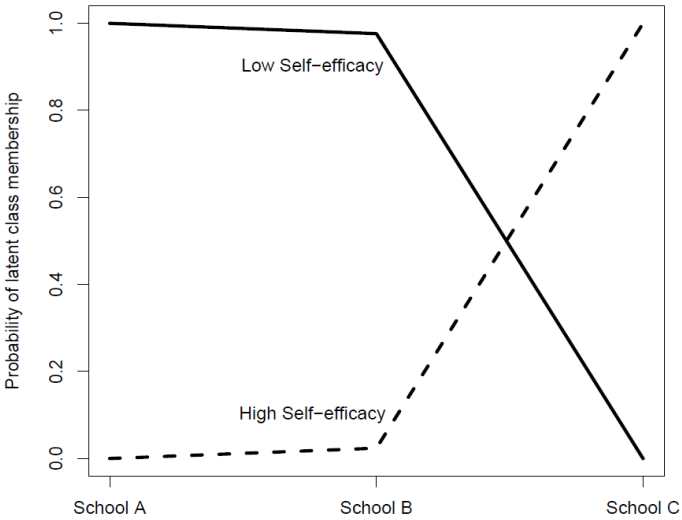

Fig. 3 Estimated prior probabilities at varying levels of school according to the fitted 2-class latent regression model for the self-efficacy construct.

Figure 4 shows the predicted prior probabilities of latent class membership at varying levels of school for the social influences construct. We can see that students from school A and students from school B both have 100% prior probability of belonging to the more family-oriented class. On the other hand, students from school C are almost equally likely to belong to either the family-oriented class or to the friends-oriented class.

TABLE IV
ESTIMATED CLASS CONDITIONAL OUTCOME PROBABILITIES FOR THE SOCIAL INFLUENCES CONSTRUCT

Manifest variables	CLASS 1				CLASS 2			
Social influence from friends*	Yes 100.00 %	No 0.00%			Yes 93.49%	No 6.51%		
Social influence from parents**	Yes 74.97%	No 25.03%			Yes 90.88%	No 9.12%		
Social influence from grandparents ***	None 17.05%	Tradi-tional fruit juice 30.03%	Wild foods 16.17 %	Tradi-tional tea 36.74%	None 0.00%	Tradi-tional fruit juice 30.48%	Wild foods 21.42 %	Tradi-tional tea 48.10%

Social Influence was evaluated by using the question: *When you are with your friend, and he or she eats TFs, do you also choose to eat TFs? ** Do you choose to eat the same food that your parents are eating when the meal has TFs? ***Which TFs do you recall from the recommendation of your grandparents?

4. Discussion

To the best of our knowledge, this is the only study on the behaviour of children towards TFs by means of the ASE theory: attitude, self-efficacy and social norms in rural school settings. The latent class approach used in this study characterizes classes of students in each construct of the ASE theory and then directly estimates the association between these latent classes and school (concomitant variable) for each construct, without the need for a separate regression analysis.

In the attitude construct, we found two latent classes, one interpreted as having a more positive attitude towards TFs than the other. These groups represent 75.3% and 24.7% of the population, respectively. Children across schools in Guasaganda currently have no teaching about TFs nor about the importance of its consumption in their current curricula [18]. This could explain our findings that school currently has no effect on the attitude of children towards TFs. Future research could evaluate whether interventions at school level that promote the consumption of TFs can be effective to improve the attitude of the children in the Guasaganda community. School-based nutrition education is key for health promotion and to improve diet [8, 19].

In the self-efficacy construct, we also found two latent classes: a low self-efficacy class which was estimated to group the majority of the children (51.03%); and a high self-efficacy class which was estimated to represent 48.97% of the studied children. Furthermore, we found that the school of the children influences self-efficacy ($p<0.0001$). This effect could be explained by differences in the schools related to quality of education. Students with better education outcomes are able to make better choices, such as choosing traditional healthy foods over unhealthy foods. In particular, students from Millennium schools with modern infrastructure and one teacher for each grade (such as school C) potentially have better education outcomes than students from the less modern conventional schools (e.g., school B) or from the united schools (e.g. school A). This could explain why students from school C are estimated to have a 100% probability of belonging to the high self-efficacy class while students from school A and students from school B have a very high probability of belonging to the low self-efficacy class.

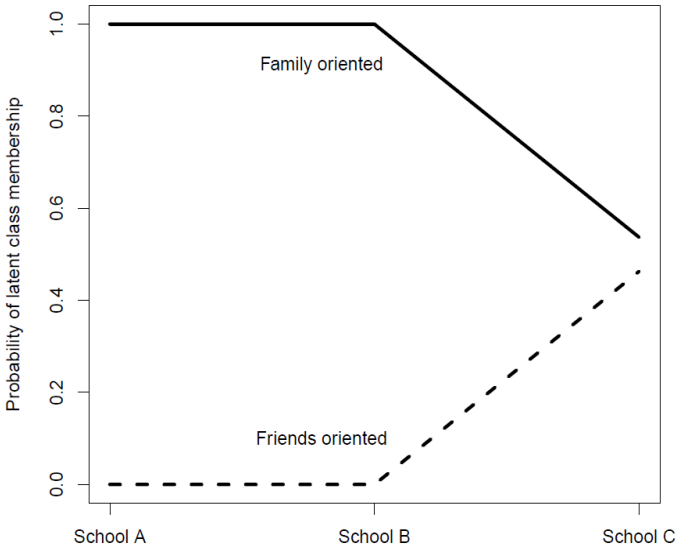

Fig. 4 Estimated prior probabilities at varying levels of school according to the fitted 2-class latent regression model for the social influences construct.

For the social norm construct, we also found two latent classes, which could be interpreted as a family-oriented class and a friend-oriented class. Results of the model show that the former class represents 77.70% of the population, whereas the latter is estimated to represent 22.30% of it. School is for social norms an important predictor for these class memberships ($p<0.0001$). In order words, we found that there are significant differences among schools in terms of who influences children in their eating behaviour. In fact, we find that students from school A and students from school B both have 100% probability of belonging to the more family-oriented class while students from school C are almost equally likely to belong to either the family-oriented class or to the friends-oriented class. The fact that more traditional families with family-oriented children prefer to register their children in more traditional schools in Guasaganda, such as conventional or united schools, could explain these results.

An extra element of novelty of our study is that we are, to our knowledge, the first researchers who have studied indigenous students in Guasaganda and have characterized their behaviour towards traditional foods in a school setting. It is also important to mention that these students belong to a

unique context because they live in a highly biodiverse and remote environment and they still practice traditional eating culture to some degree. Our results provide with useful information that can be used to promote TFs consumption in the rural community of Guasaganda, which has a high prevalence of malnutrition, and safeguard TFs species among children living in this rural community. Even though, we did not collect socioeconomic data of the children because of study restrictions, a rapid rural appraisal of the community of Guasaganda showed to us that these children had similar living conditions, culture, socioeconomic conditions and lifestyle, although from our results we may infer that students from school A and B belong to more traditional families. We, therefore, believe that these factors may not affect much the conclusions reached in our study.

5. CONCLUSIONS

School was significantly associated with self-efficacy, and, with the social influence on children in their consumption of TFs. Based on these results, we conclude that school is an important factor to predict behaviour towards TFs for the studied children. In particular, we estimate that children in united (A) and conventional (B) schools have a high probability of having less self-efficacy. This result could be explained by a lower quality of education in these schools which have less modern infrastructure, and, for the case of school A, all students from 2nd to 5th grade are in a single classroom guided by only one teacher. Moreover, children in united (A) and conventional (B) schools have a high probability of being more family-oriented, which could be explained by the fact that more traditional families with family-oriented children prefer to register their children in more traditional schools such as A and B. The results of this study could be used to implement future interventions in the united school type A and the conventional school type B to promote the consumption of TFs. In particular, it may be important to consider the parents of the children in their education process, create an adequate education environment in schools, provide educational support to children and include content in the curricula about the advantages and the importance of consuming TFs. It is important to remark that we should be careful with generalizing these results to the whole population of schools and students of Guasaganda, since only schools and students that were accessible and were willing to participate in the study were considered. This study serves, however, as a good reference that contributes to the understanding of the behaviour of children towards TFs in rural areas of Ecuador, which is essential to promote its consumption.

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