adolescents

Article

The Development and Validation of a Tool to Evaluate the Determinants of Iron-Rich Food Intake among Adolescent Girls of Senegal

Aminata Ndene Ndiaye [1], Jérémie B. Dupuis [2], Nafissatou Ba Lo [3], El Hadj Momar Thiam [3], Mohamadou Sall [1] and Sonia Blaney [4,*]

[1] Institut de Recherche Population, Développement et Santé de la Reproduction/IPDSR, Université Cheikh Anta Diop/UCAD, Dakar 10700, Senegal; litzamina@outlook.fr (A.N.N.); sallmoham@yahoo.fr (M.S.)
[2] Vice-Rectorat à l'Enseignement et à la Recherche, Université de Moncton, Moncton, NB E1A 3E9, Canada; jeremie.dupuis@umoncton.ca
[3] Conseil National de Développement de la Nutrition, Dakar 45001, Senegal; nlo@cndn.sn (N.B.L.); ethiam@cndn.sn (E.H.M.T.)
[4] École de Nutrition, Université Laval, Québec, QC G1V 0A6, Canada
* Correspondence: soniablaney@hotmail.com

Abstract: To reduce anemia among adolescent girls, factors that influence the consumption of iron-rich foods/IRF have not been investigated, and neither has a tool been developed to assess its determinants. Using the extended version of the theory of planned behaviour/eTPB, this study aims to develop and validate a questionnaire assessing individual and environmental factors that could influence IRF intake among Senegalese adolescent girls aged 10–19 years old. First, eight focus group discussions (FGDs) were held in different regions to identify salient beliefs related to each of the four constructs of the eTPB. Information from FGDs was used to develop a questionnaire that was administered to the first group (n = 200) of girls. Principal component and exploratory factorial analyses were then performed to identify latent factors for each construct. A modified version of the tool was administered to the second sample of girls (n = 400), and confirmatory factorial analyses were conducted. Hancock and Muller's H reliability index was computed on the final model. Most metrics for fit indices were respected, and the H value was satisfactory. This study proposes a tool that could be used to explore determinants of the consumption of IRF among adolescent girls.

Keywords: adolescent girls; questionnaire; assessment; iron-rich foods consumption; anemia

Citation: Ndiaye, A.N.; Dupuis, J.B.; Lo, N.B.; Thiam, E.H.M.; Sall, M.; Blaney, S. The Development and Validation of a Tool to Evaluate the Determinants of Iron-Rich Food Intake among Adolescent Girls of Senegal. *Adolescents* **2024**, *4*, 231–247. https://doi.org/10.3390/adolescents4020017

Academic Editor: Laura L. Hayman

Received: 1 February 2024
Revised: 2 May 2024
Accepted: 14 May 2024
Published: 17 May 2024

1. Introduction

Worldwide, anemia, defined as having a hemoglobin concentration below normal (less than 12 g/dL and 11 g/dL in non-pregnant women of reproductive age and children aged 6–59 months old, respectively), remains a public health concern that affects 30% of women of reproductive age (WRA) (15–49 years) and about 40% of children 6–59 months old [1–3]. Over the past two decades, the prevalence of anemia has stagnated [3] among WRA, putting the world off track to achieve the 2025 nutrition target [4] and the 2030 Sustainable Development Goal [5] of halving the prevalence of anemia among this group. The African continent remains one of the most affected regions, especially the West and Central African sub-regions, with about one out of two women of reproductive age being anemic [3]. Adolescent girls are even at higher risk of anemia given their increased iron requirements, limited iron intake and high prevalence of infections and worm infestations.

Although anemia is a complex issue, the main recognized cause is iron deficiency, which represents between 10 and 60% of cases [1,6,7]. Poor diet quality has been identified as one intermediate determinant of a deficient iron status [8]. Unfortunately, tackling drivers of a poor diet among adolescents has been a failure, which has resulted in small improvements in malnutrition among this group in past decades [9].

Local norms and practices are considered among the underlying factors that could influence adolescent micronutrient status [8], in addition to environmental components, which can limit access to healthy choices [10]. To improve adolescent girls' nutrition, among others, programs should further focus on modifying misconceptions and social norms through behaviour-change communication for increasing nutrient [7] intakes, such as iron, through a higher consumption of iron-rich foods (IRFs). Enhancing access to healthy diets is also essential.

Nevertheless, to be successful, interventions to improve adolescent nutrition must be evidence-based. To our knowledge, comprehensive research is scant with regard to the investigation of factors that may determine the consumption of IRF among adolescent girls. Furthermore, to explore individual and environmental factors that could influence IRF consumption, psychosocial theories could be valuable and effective for successful behaviour change. In fact, understanding these factors could help tailor programs aiming at behavioural and environmental changes. Such actions could mitigate the consequences of iron deficiency anemia, such as growth retardation, reduced cognitive function and immune system responses in adolescent girls, and benefit the next generation [11].

However, to examine individual and environmental factors of a behaviour, a valid and reliable tool must be used. To our knowledge, no tool has been developed to investigate the determinants of IRF consumption among adolescent girls living in low- and middle-income countries where anemia remains a critical issue.

Using the extended theory of planned behaviour (eTPB) [12], which integrates individual and environmental factors likely to influence behaviour, the aim of this research was to develop and validate a tool for assessing the psychosocial and environmental determinants of IRF intake among Senegalese adolescent girls. This measurement tool will help to monitor the achievement of programs developed by the "Conseil national de développement de la nutrition (CNDN)" and its partners in the field of nutrition.

2. Materials and Methods

In this research, the adopted methodology is modelled from that used in previous studies conducted by our research group. These studies also aimed to validate a measurement tool, but these investigations were focused on determinants of dietary intake among young children [13–15].

2.1. Design and Sampling

This research uses a cross-sectional design. In each region of Senegal, a list of all enumerating units was made, and in each region, census units were randomly selected proportionally to the population. In each unit, households with adolescent girls (10–19 years old) were listed, and eleven households were selected randomly.

This study comprises the three following samples:

Sample #1: Eighty adolescent girls from five (5) different regions of the country (Dakar, St-Louis, Tambacounda, Matam and Kolda) who were asked to participate on a volunteer basis in eight (8) focus group discussions (FGDs). Results were only used to elaborate on the tool's items. Sociodemographic characteristics of this group were not assessed.

Sample #2: Two hundred adolescent girls from each of the 14 regions of Senegal were selected for the first step of the validation process. A sample size of 200 for exploratory factorial analysis (EFA) is considered acceptable/fair [16,17]. Post hoc, this sample size was deemed to be sufficient based on the KMO and commonalities obtained with the EFA [18].

Sample #3: Four hundred adolescent girls from each of the 14 regions of Senegal were used for the second step of the validation process, the confirmatory factor analysis (CFA).

2.2. Preparatory Work

Enumerators were hired using the following criteria: holding a university degree, being fluent in relevant languages (Wolof, Pular) and having experience in nutrition or health

surveys. Twenty-five surveyors, including eight (8) women, were recruited, and trained on survey tools and methodology. Theoretical training was completed by practical exercises.

2.3. Behaviour of Interest

In this study, in line with the definition used in Demographic and Health Surveys, IRFs include eggs, meat such as beef, pork, lamb, chicken, liver, heart, other organs, fish and shellfish [19]. At the very start of the questionnaire, the definition of IRF was written down, and each interviewer read this definition to each participant before starting to ask questions about each concept. Moreover, throughout the interview, the definition was also reiterated.

2.4. Theoretical Framework

The eTPB (Figure 1) [12,20] was used to guide the development of the questionnaire as it combines a component of the environment to the initial TPB constructs (attitude (ATT), subjective norm (SN), perceived behavioural control (PBC)). This model postulates that the intention is the main predictor of a behaviour. In turn, the intention is predicted by ATT, which comprises two sub-constructs, namely individual's beliefs about the behaviour and the evaluation the person perceived about aftermaths of adopting it or not [20]. Similarly, SN is determined by two sub-constructs, which are the importance given by an individual to the point of view of people or groups of people around him/her (normative beliefs) and by his/her motivation to comply [20]. PBC is the degree of control the individual belief (control beliefs) can exercise over the behaviour compounded by his/her perception of the degree of ease or difficulty with which the behaviour is adopted [21]. Environmental factors are external and consist of social and physical characteristics (e.g., health facilities, household environment, workplaces, sociodemographic characteristics, food markets) that can influence ATT, SN and PBC through moderation as well as the operationalization of the intention to a concrete behaviour [22].

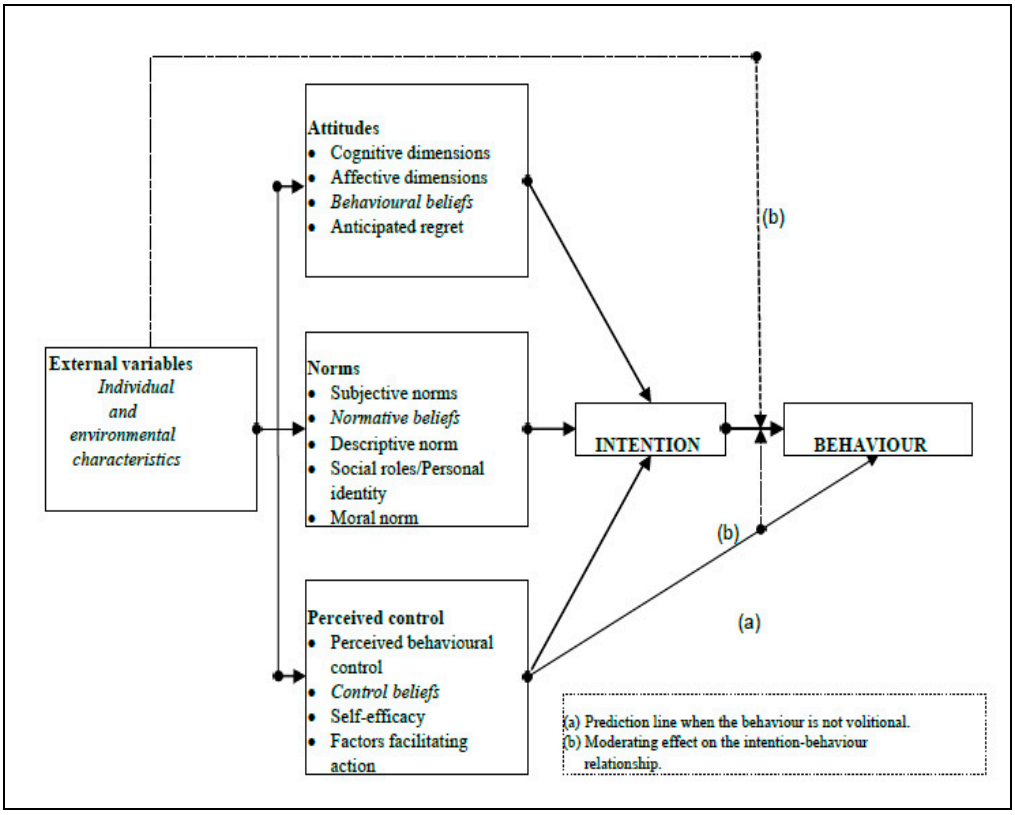

Figure 1. Extended theory of planned behaviour/eTPB [12,20].

2.5. Questionnaire Development and Validation Process

The development of the questionnaire and the validation process were based on Gagné and Godin's recommendations [23].

2.5.1. Identification of Salient Beliefs and Environment-Related Factors through FGDs

The first step in developing the questionnaire was to identify the salient beliefs associated with each of the individual concepts in the TPB model, as well as to investigate certain environmental factors likely to promote or hinder IRF consumption.

Thus, using a discussion guide, the following data on each of the constructs of the theoretical model were collected during FGDs held in communities or schools, namely (a) perceived advantages and disadvantages to the adoption of the behaviour (ATT construct), (b) people or groups of people who would approve/disapprove of the adoption of the behaviour (SN), (c) perceived barriers and factors facilitating the adoption of the behaviour (PBC) and (d) environment factors that may/may not facilitate the consumption of IRF [23]. Each question was asked to the group first, but every adolescent was also invited systematically to respond on an individual basis.

FGDs were conducted either in the local language (Wolof or Pular) or in French by teams of two (2) enumerators who were previously trained by the authors. The discussion was tape-recorded. The content was translated into French by each team of enumerators. Thereafter, the first author also listened to the recording and checked if the translation was accurate and complete. A qualitative analysis of transcriptions was conducted to extract salient beliefs associated with each construct using the following approach: (a) familiarization by the two authors with the content by reading each transcription several times, (b) organization of all responses under each relevant construct, (c) total of occurrences for each similar answer associated with each construct and (d) identification of themes and assignment answers under each construct [24]. Answers that could not be allocated to a construct with an occurrence of three (3) or less were left out. Both authors analyzed each transcription independently and discussed their findings afterwards. It should be noted that in accordance with Gagné and Godin's [23] guidelines, the results of the FGDs were the main reference for the formulation of the questionnaire items and are therefore not presented in this article.

2.5.2. Questionnaire Design

A questionnaire was developed using all information that came out from FGDs. Although this information was the primary source for the formulation of items of the questionnaire, it was supplemented with data from the literature [25–27]. An item to assess the intention of implementing the behaviour was also included, as well as those to measure each construct directly (ATT: two items, SN: three, PBC: two) [23,28]. The basic questionnaire contained 35 items: 11 for ATT, 14 for SN, 4 for PBC and 6 for environmental factors (Supplementary Materials). Five-level Likert scales were used to gather participants' responses to every item [23]. Pictograms of angry/smiley faces were used to ease the record of answers [13,14].

2.5.3. Questionnaire Validation

The next stage of the questionnaire development was its validation. To this end, the content was reviewed by three national experts from the CNDN and University Cheikh Anta Diop of Dakar, Senegal. Following negligible modifications, the questionnaire was pre-tested with a group of seven (7) adolescents in the Dakar region to ensure clarity and consistency in the wording of the items. It should be noted that these seven (7) adolescents were selected at random just to do the pre-test stage of the questionnaire developed. The initial questionnaire was then administered to Sample #2 through face-to-face interviews, during which the surveyor first explained to each adolescent how to express their answers on the Likert scale. Then, the enumerator read each questionnaire item. The participants were then invited to indicate their answers with their fingers on each scale or to mark them

with a pen. The questionnaire was subsequently administered to Sample #3 by the same surveyors as Sample #2 using a similar approach.

2.6. Sociodemographic Characteristics

For Samples #2 and #3, sociodemographic characteristics of each household and adolescent girl were collected with adapted versions of the Household and Women Demographic and Health Survey questionnaires [29]. Data were gathered through face-to-face interviews with the head of each household and every adolescent girl, respectively.

2.7. Data Analysis

The same process for data analysis as described in Ninamou et al. [14] was used in the present study. As such, for each item of the questionnaire, a numeric value was assigned to each response on the Likert scale, ranging from a score of −2 (e.g., strongly disagree/unlikely/disapprove) to a score of +2 (e.g., strongly agree/likely/approve). A principal component analysis (PCA) was conducted with IBM SPSS Statistics [30] on data collected from Sample #2 to reduce the number of items while still respecting the following assumptions for sampling adequacy: having a Kaiser–Meyer–Olkin (KMO) measure > 0.7 and ensuring that correlations between items were significant (Bartlett's test < 0.05) [18]. The principal component extraction method was used in each PCA to understand the structure of the data set as well as to reduce its size while preserving the most information. The varimax rotation method was utilized to maximize the dispersion of factor loading within factors [18]. Correlation matrices were examined: items that had 90% or more of their correlations below 0.3 with the other items or that had correlations above 0.9 were removed [29].

Thereafter, an exploratory factor analysis (EFA) was conducted with IBM SPSS Statistics [30,31] using the principal axis extraction method with varimax rotation with all remaining items. Principal axis method has an advantage as it can, like PCA, analyze not only correlations but also covariances [18]. All factors with eigenvalues above 1 were retained. For each factor, items having a loading value above 0.4 were interpreted [32].

To confirm the scale's structure, a confirmatory factor analysis (CFA) was performed on data collected from Sample #3 with Mplus 8 [31] with all factors suggested by the EFA. If the hypothesized structure that emerged from the EFA with Sample #2 is found to adequately fit the data from a different sample (Sample #3), it validates that questionnaire's structure is sound.

The Weighted Least Squares Means and Variances (WLSMV)-adjusted estimator was used as the data were not continuous. The following indicators and criteria were selected to conclude the "goodness of fit" of the final factorial models that were tested: (a) chi-square statistic with a *p*-value greater than 0.05, (b) comparative fit index (CFI) with a value above 0.95 (c) Tucker–Lewis index (TLI) with a value above 0.95, (d) root mean square error of approximation (RMSEA) and its 90% confidence interval below 0.08 and (e) standardized root mean square residual (SRMR) of 0.08 or below [33].

For each model, the Wald test was also conducted to assess if each item and correlation between items significantly contributed to the model fit. Thus, items that were non-significant (p-values ≥ 0.05) were eliminated from the subsequent analysis model [34]. The Lagrange Multiplier method, interpreted with modification indices in Mplus, was also used to modify the models. Theoretical considerations and justifications were always used as the primary motivations for model modifications [35]. For both tests, every modification was treated as a new model to test.

All final models' construct fidelity was evaluated with Hancock and Mueller's H reliability coefficient, which was estimated using the items' standardized factor loading. An H value above 0.80 was considered adequate [36].

Frequency distributions were performed on answers for each item and both samples. Chi-square and Fisher's exact tests were used to assess differences in sociodemographic

characteristics between Samples #2 and #3. A *p*-value below 0.05 indicated significant differences between proportions.

3. Results

A total of 80 adolescent girls from five regions of Senegal participated in FGDs. Samples #2 and #3 are described in Table 1. There were significant differences ($p < 0.05$) in proportions between the two samples with regard to religion, ethnic group, level of education, literacy and the adolescent's perception of her health status.

Table 1. Sociodemographic characteristics of Samples #2 and #3 of adolescent girls used for the validation process of the questionnaire.

Characteristics	Sample #2 (n = 200) %	Sample #3 (n = 400) %	*p*-Value *
Age (years)			
10–14	48.0	49.3	0.083
15–19	52.0	50.8	
Religion			
Muslim	93.0	97.3	
Christian	6.5	2.5	0.040
Animist	0.0	0.3	
No religion	0.0	0.0	
Other	0.5	0.0	
Ethnic group			
Wolof	38.5	31.8	
Peul	28.0	34.0	
Serere	20.0	10.3	<0.001
Mandingue	3.5	10.0	
Soninke	2.5	4.3	
Diola	1.5	4.5	
Others/non-Senegalese	6.0	5.3	
Level of education			
No formal education	16.5	25.5	
Some primary	25.5	36.3	
Primary completed	40.0	26.5	<0.001
Some secondary	18.0	10.8	
Secondary completed	0.0	0.8	
More than secondary	0.0	0.3	
Literacy			
Able to read a full/part sentence aloud	79.0	61.8	<0.001
Not able	21.0	38.3	
Health status perception			
Very good	34.5	23.5	
Good	34.0	46.5	0.015
Average	28.5	25.5	
Bad	3.0	4.3	
Very bad	0.0	0.3	
Exposure to mass media at least once a week			
Reads newspapers (vs. not at all/<once a week)	5.5	5.3	0.999
Watches TV (vs. not at all/<once a week)	76.5	71.8	0.240
Listens to radio (vs. not at all/< once a week)	19.5	17.8	0.655

* Chi-square and Fisher tests were used to identify significant differences ($p < 0.05$) between proportions.

After the removal of four items from the initial questionnaire (ATT, items 2.2 and 3.7; SN, item 4.3; environment, item 7.2), KMO values for PCA were 0.828, 0.874, 0.568 and 0.691 for ATT (9 items), SN (13), PBC (4) and the environment (5), respectively, which are

considered as acceptable for the most part [29], with PBC being suboptimal, perhaps due to a smaller number of items. *p*-values from Bartlett's test of sphericity χ^2 were all below 0.05.

The results of the EFA are shown in Table 2. In total, seven factors explained 61.3% of the variance associated with the model, and every factor had an eigenvalue above 1.

Table 2. Results from the exploratory factor analysis of items of the questionnaire on sample #2 (n = 200).

Constructs and Items	**Rotating Factor Loadings**						
	Factor 1	**Factor 2**	**Factor 3**	**Factor 4**	**Factor 5**	**Factor 6**	**Factor 7**
Attitude *If I consume IRF every day, this. . .*							
3.5 Will allow me to make up blood loss during menses	0.694						
3.1 Will allow me to be in good health	0.675						
3.6 Will allow me to have a lot of vitamins	0.673						
3.2 Will allow me to grow	0.668						
3.4 Will prevent anaemia	0.633						
3.3 Will allow me to be less tired	0.596						
2.1 For me, consuming IRF. . .will be useful	0.481						
3.9 Can cause problems during menses		−0.695					
3.8 Can cause illnesses such as diarrhoea, hypertension, indigestion, etc.		−0.642					
Subjective Norm *If I consume IRF every day, my. . .*							
5.5 Cousins (male) will approve/disapprove				0.814			
5.6 Cousins (female). . .				0.806			
5.4 Brothers. . .				0.789			
5.3 Sisters. . .				0.717			
5.7 Aunts. . .				0.701			
5.8 Uncles. . .				0.647			
5.10 Grandfather. . .				0.625		0.548 *	
5.9 Grandmother. . .				0.616		0.509 *	
5.11 Friends. . .				0.606			
5.2 Mother. . .			0.606				
5.1 Father. . .			0.588				
4.1 Important persons for me will recommend that I consume IRF every day			0.452				
4.2 Most important persons think that I should eat IRF every day			0.407				
Environment/Perceived Behavioural Control							
7.6 At home, we don't cook a sufficient quantity of IRF **					0.637		
6.2 (PCB) For me, consuming IRF every day is easy					−0.605		
7.3 At home, we don't cook IRF every day **					0.580		

Table 2. *Cont.*

Constructs and Items	Rotating Factor Loadings						
	Factor 1	**Factor 2**	**Factor 3**	**Factor 4**	**Factor 5**	**Factor 6**	**Factor 7**
6.1 (PCB) I feel able to consume IRF every day					−0.491		
7.1 The high price of IRF **					0.484		
7.4 My parents/tutors do not give me enough money to buy IRF **					0.453		
7.5 There are no IRF on sale near my home							0.543
Perceived Behavioural Control							
6.3 If I had money, I would be able to consume IRF every day							
6.4 If I had more control over what we cook at home, I would be able to consume IRF every day							
Eigenvalues	3.68	1.47	1.58	7.36	2.64	1.23	1.04
Variance explained (total = 61.3%)	11.9	4.7	5.1	23.7	8.5	4.0	3.4

* For CFA, items 7.1, 7.3, 7.4 and 7.6 were grouped under factor 7 as item 7.5 was eliminated. ** For CFA, items 5.9 and 5.10 were included in factor 4, and items 6.3 and 6.4 constituted the new factor 6.

For the ATT construct, seven and two items were, respectively, loaded on two distinct factors. Items loaded on factor 1 were related to the benefits of consuming IRF, while the two items loaded on factor 2 were associated with potentially harmful consequences.

Similarly, for the SN construct, items (13) were loaded on two factors. Four items were loaded on factor 3. They were related to the girl's parents and of important persons in general who would approve/disapprove if the adolescent consumed IRF each day. Nine (9) items were loaded on factor 4. These items were related to the adolescent perception of the approval/disapproval of all persons besides her parents with regard to their consumption of IRF each day.

For the PBC construct, two items (6.3 and 6.4) were not loaded on any factor. They were related to specific control beliefs perceived by the adolescent. The two other items (6.1 and 6.2) were loaded with items related to the environment on factor 5. PBC-related items were associated with the overall behavioural control perceived by adolescents when they were able to consume IRF each day, while environmental items were related to the physical and financial access to IRF. For each factor of every construct, loading coefficient values were all above 0.4.

The first CFA model tested the factor structure that emerged from the EFA, with the exclusion of item 7.5, which loaded by itself (Table 2), but with the inclusion of items 6.3 and 6.4 as their own factor (new factor 6) to further test if these items needed to be removed. Moreover, the two related PBC items (6.1 and 6.2) and the four items (7.1, 7.2, 7.4 and 7.6) related to the environment that were all part of factor 5 in EFA were grouped in two different factors leading to a total of seven factors to be integrated to the CFA. As Table 3 demonstrates, fit indices for Model 0 were unmet. Model 1 was run after excluding the correlation between factors 4 and 5 (factor constituted by items 6.1 and 6.2), given its non-significance based on the Wald test. Fit indices improved, but the criterion for the chi-square test was not respected. In Model 2, the correlation between factors 2 and 5 was removed as it was insignificant, but the results of all indices were still unacceptable. Model 3 was run by adding a correlation term between items 4.1 and 4.2, given that they were both direct measures of the SN construct. Items 6.3 and 6.4 did indeed remain significant as a factor. All criteria were met besides that of the chi-square test. This model is in line with the previous EFA as it shows that all items remain on their factors.

Table 3. Fit indices for each model of confirmatory factorial analysis on sample #3 (n = 400).

Indices *	Model 0	Model 1	Model 2	Model 3
χ^2	1664.7	1520.7	1514.2	1325.5
df	384	385	386	385
p	<0.001	<0.001	<0.001	<0.001
RMSEA	0.09	0.09	0.09	0.08
90% C.I.	0.09–0.10	0.08–0.09	0.08–0.09	0.07–0.08
p	<0.001	<0.001	<0.001	<0.001
CFI	0.94	0.94	0.95	0.95
TLI	0.93	0.94	0.94	0.95
SRMR	0.06	0.06	0.06	0.06

* χ^2: chi-squared test value; df: degree of freedom, RMSEA: root mean square error of approximation; CI: confidence interval; CFI: comparative fit index; TLI: Tucker–Lewis index; SRMR: standardized root mean square residual.

With the exception of one factor, Hancock and Muller's reliability coefficients for the final model were all above 0.85 for each construct and related factors: (a) ATT: 0.92 and 0.88 for factors 1 (items 2.1, 3.1 to 3.6) and 2 (items 3.8 and 3.9), respectively; (b) SN: 0.85 and 0.97 for factors 3 (items 5.1, 5.2, 4.1 and 4.2) and 4 (items 5.3 to 5.11); (c) PBC: 0.91 and 0.70 for factors 5 (items 6.1 and 6.2) and 6 (items 6.3 and 6.4); and (d) environment: 0.85 for factor 7 (items 7.1, 7.3, 7.4 and 7.6).

Frequency distributions of data between adolescent girls' responses in Samples #2 and #3 are shown in Table 4. Overall, significant differences between both samples were observed for items related to SN and to the environment.

Table 4. Frequency distributions (%) of responses to items on each construct of the questionnaire for Sample #1 (n = 200)/Sample #2 (n = 400).

Constructs and Description of Items	**Scores and Answers' Options**				
	−2	−1	0	1	2
Attitude	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
2.1 For me, consuming IRF every day will be useful *,†	0.5/2.5	3.0/1.3	4.5/9.3	47.0/49.3	45.0/37.8
2.2 For me, there is no disadvantage in consuming IRF every day †	8.0/3.3	11.5/6.5	11.0/13.8	40.0/47.5	29.5/29.0
*If I consume IRF every day, this…***					
3.1 Will allow me to be in good health	0.5/1.3	1.0/2.5	4.5/10.3	48.5/44.8	45.5/41.3
3.2 Will allow me to grow †	0.0/0.5	3.0/2.8	7.0/14.5	50.0/49.5	40.0/32.8
3.3 Will allow me to be less tired	0.0/2.0	4.5/6.3	18.5/19.0	49.0/46.8	28.0/26.0
3.4 Will prevent anemia	1.0/1.5	2.5/3.0	7.5/14.5	43.5/45.0	45.5/36.0
3.5 Will allow me to make up blood loss during menses	1.5/2.0	3.0/2.5	27.0/29.0	35.0/41.0	33.5/25.5
3.6 Will allow me to have a lot of vitamins	1.0/0.3	3.5/2.0	10.5/12.8	56.5/57.3	28.5/27.8
3.7 Will cause a weight gain	8.0/8.8	17.5/17.3	27.5/28.0	12.5/16.3	34.5/29.8
3.8 Can cause illnesses such as diarrhoea, hypertension, indigestion, etc.	28.5/27.5	39.0/32.0	23.0/30.5	1.5/2.8	7.5/6.3
3.9 Can cause problems during menses	25.5/24.0	32.5/32.8	32.0/32.3	1.5/2.8	8.5/8.3
Subjective norm	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
4.1 Important persons for me will recommend that I consume IRF every day *,†	3.5/4.5	10.0/13.3	10.0/16.5	55.0/42.0	21.0/23.8
4.2 Most important persons think that I should eat IRF every day *	1.0/2.8	13.0/12.5	15.0/18.5	55.0/43.8	16.0/22.5
4.3 If I consume IRF every day, nobody will disagree *	4.0/3.3	7.0/4.0	10.0/15.0	55.5/48.3	23.5/29.5
	Strongly disapprove	Disapprove	+/− Approve	Approve	Strongly approve

Table 4. *Cont.*

Constructs and Description of Items	**Scores and Answers' Options**				
*If I consume IRF every day, my. . .***					
5.1 Father will. . .	1.0/1.0	1.0/0.5	24.5/32.3	22.0/20.8	51.5/45.5
5.2 Mother will. . .	0.5/0.5	0.5/0.8	13.5/21.0	20.0/19.0	65.5/58.8
5.3 Sisters will. . . †	0.5/0.3	1.0/1.0	34.5/39.3	33.0/18.0	31.0/41.5
5.4 Brothers will. . . †	1.0/0.3	2.0/1.0	40.0/45.8	31.5/178	25.5/35.3
5.5 Cousins (male) will. . . †	0.0/0.5	2.0/1.3	49.0/51.3	31.0/17.3	18.0/29.8
5.6 Cousins (female) will. . . †	0.0/0.5	2.5/1.0	43.0/46.8	32.5/19.8	22.0/32.0
5.7 Aunts will. . .	0.5/1.3	1.5/1.0	36.5/39.0	30.0/21.5	31.5/37.3
5.8 Uncles will. . .	1.0/1.3	3.0/1.5	41.5/46.8	24.0/17.5	30.5/33.0
5.9 Grandmother will. . .	1.5/1.0	4.0/1.5	47.5/47.5	20.0/17.5	27.0/32.5
5.10 Grandfather will. . .	0.5/1.3	3.5/2.0	53.5/53.0	21.0/14.3	21.5/29.5
5.11 Friends will. . .	0.5/0.8	1.0/1.3	36.5/42.8	31.0/21.0	31.0/34.3
Perceived Behavioural Control	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
6.1 I am able to consume IRF every day *,†	8.0/16.0	21.0/21.8	11.5/10.5	41.0/31.5	18.5/20.3
6.2 For me, consuming IRF every day is easy *,†	12.0/21.8	30.0/26.5	15.0/15.0	32.5/24.8	10.5/12.0
6.3 If I had money, I would be able to consume IRF every day ****	1.5/1.3	4.0/3.8	8.5/7.5	46.5/48.5	39.5/39.0
6.4 If I had more control over what we cook at home, I would be able to consume IRF every day ****	2.0/5.3	17.5/14.5	12.5/14.0	47.5/42.8	20.5/23.5
Environment	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
7.1 The high price of IRF †	9.0/3.0	12.0/6.0	9.5/14.8	41.0/38.8	28.5/37.5
7.2 Eating with the family †	17.0/8.8	32.0/30.5	20.0/20.8	23.0/25.5	8.0/14.5

Table 4. *Cont.*

Constructs and Description of Items	Scores and Answers' Options				
7.3 At home, we don't cook IRF every day †	7.5/3.3	19.0/16.3	12.5/16.3	46.0/37.5	15.0/26.8
7.4 My parents/tutors do not give me enough money to buy IRF †	9.0/7.0	25.5/18.3	19.0/18.0	34.0/34.8	12.5/22.0
7.5 There are no IRF on sale near my home †	14.0/11.3	37.0/27.5	9.0/14.3	29.5/29.8	10.5/17.3
7.6 At home, we don't cook a sufficient quantity of IRF †	14.5/5.8	23.0/16.8	13.0/14.8	33.5/40.8	16.0/22.0

* This item is a direct measurement of the construct of either attitude, subjective norm or perceived behavioural control. ** Items listed below (3.1 to 3.9) measure behavioural beliefs. *** Items listed below (5.1 to 5.11) measure normative beliefs. **** Items 6.3 and 6.4 measure control beliefs. † indicates a significant difference ($p < 0.05$) in proportions between the two samples using chi-square and Fisher tests.

4. Discussion

The aim of this study was to develop and validate a measurement tool to assess individual and environmental determinants of IRF intake among Senegalese adolescent girls. Guided by the extended version of the TPB, FGDs were held in different areas of the country, and a literature review was performed to identify salient beliefs and environmental factors related to the behaviour of interest. Information from both sources was used to design a questionnaire which was administered to two different groups of adolescent girls located in the 14 regions of the country. Thereafter, data from both samples were used for the validation process conducted through EFA and CFA. EFA analysis shows that seven factors fitted the data for each of the four constructs (attitude, subjective norm, perceived behavioural control and environment), with the seventh factor consisting of only one item. All factors were subsequently considered for CFA, and one was added to distinguish factors (and items) related to PBC and the environment. Four models were run, and for each of them, the chi-square test criterion was unmet. However, the criteria for all other indicators were respected. Items (6.3 and 6.4) related to factor 6 were eliminated, given the Hancock H reliability value below the set criterion. The final questionnaire included 30 items.

Throughout CFA, adjustments were made to improve the models' goodness-of-fit, mainly by removing or adding correlations between factors or items. These modifications conformed with what could be expected from the theoretical framework. For example, the deletion of the correlation between factors 4 and 5, which included items related to indirect and direct measurements of SN and PBC constructs, respectively, is reasonable given these are two distinct measures of each of these constructs: indirect measurements help to understand what "drives behaviours", while direct ones are generally more associated with the intention [23]. The same applies to the correlation between factors 2 and 5, which are composed of items of the indirect measurement of the ATT construct. The addition of the correlation term between items 4.1 and 4.2 to the CFA is explained by the fact that both are direct measures of the SN construct.

It should also be noted that the structure that came out from the CFA was similar to what emerged from the EFA, although the two populations had different sociodemographic characteristics. Noteworthy is the fact that the EFA analysis was carried out by integrating all variables at once without specifying the number of factors to be extracted, hence letting the latent constructs form naturally. As additional proof of the questionnaire's structure, the latent constructs that emerged from the EFA highly resembled the questionnaire's theoretical framework.

Although the chi-square criterion was not met, one should be cautious about using it to assess the goodness-of-fit of our final model. According to Flora and Curran [37], its value could be inflated if non-continuous data are used. In fact, the use of RMSEA and SRMR to evaluate the goodness-of-fit of models has been recommended by Maydeu-Olivares and Joe [38]. In a study aimed at developing a valid questionnaire to assess feeding practices among young Australian children, Jansen et al. [39] concluded the adequacy of their final model using indices like ours, namely RMSEA, CFI, TLI and SRMR. H coefficients also showed that our questionnaire is a reliable tool or, in other words, that the group of items represents latent constructs.

Results from the analysis of the data obtained by administrating the questionnaire to Senegalese adolescent girls show that they are aware of several benefits associated with the daily consumption of IRF. Yet, they believed that IRF could potentially cause certain illnesses and problems during menstruation. Among Iranian adolescents, Alami et al. [40] reported a positive attitude towards the importance of increasing nutrient intake, probably because they perceived benefits in doing so. Although the possibility of gaining weight as a result of daily ARF consumption was raised in the focus group discussions, this item did not emerge in EFA and CFA analyses. In contrast to our setting, in a rural area of Bangladesh, adolescent girls aged 14–17 years old (n = 23) reported that IRF should be avoided to lose weight [41]. The different situation from ours, as well as the smaller sample size of the Iranian study, could explain the difference between the perception of adolescents

in the two studies regarding the relationship between IRF consumption and weight control. Consistent with our findings, adolescent girls reported avoiding or reducing consumption of some IRF (such as fish) during menstruation [41] despite considering IRF to be good for health. In general, Fleming et al. [42] highlighted that adolescents consider good nutrition as important for their growth and development and to prevent illnesses.

Adolescent girls perceived their mother and father as important people who would agree if they consumed IRF every day. Adolescents are likely to respect their family's food practices because they consider the food provided by their parents to be the best choice given their financial possibilities. Families, especially parents, have been identified as a key driver of adolescents' food choices worldwide [42].

Adolescent girls also perceived that consuming IRF each day would not be easy and did not feel able to do so. Moreover, they reported that if they had more money and more control over what is cooked at home, they would be able to consume healthy food such as IRF daily. In fact, the mothers of these adolescents are most likely making choices about food purchased and prepared at home [43,44], making it difficult for them to exercise significant control over food preparation at home. Tumilowicz and Pelto [45] also observed that a lack of appropriate economic resources was a barrier to the consumption of healthy foods among Bangladeshi adolescents, while Fleming et al. [42] indicated that limited economic independence could hinder healthy food consumption.

Environmental barriers to the daily consumption of IRF were related to their price, adolescents' limited access to financial resources, and the fact that these foods were not cooked at home. Our findings confirm those of Fleming et al. [42], who showed that the main obstacle identified by adolescents (28%) to healthy eating was the cost of food. The high price of IRF, such as meat, was also reported in the Dakar area of Senegal by Marras et al. [46], making it likely that adolescent girls (and their families) have difficulty accessing them.

Yet, our study has weaknesses that should be highlighted. The questionnaire has been tested in only one country. Therefore, one cannot generalize about its use in other cultural and socioeconomic settings. Male adolescents were also not considered in our study, although it is likely that they face some challenges similar to those encountered by girls in accessing IRF. Yet, their perspective may also be different than that of girls and deserves to be examined. Despite these constraints, our research has several strengths. First, this is the first study investigating determinants of IRF consumption among adolescent girls using a comprehensive approach that also highly involves the target group throughout the process. This research has generated evidence on context-specific potential determinants which may influence healthy food behaviours. In the future, our tool could be used to assess the relationship between psychosocial and environmental factors and IRF intake among adolescent girls. Subsequently, results can be used to develop behaviour change programs and implement interventions to address environmental barriers that limit the consumption of IRF among adolescent girls.

In conclusion, our survey proposes a simple tool to assess individual and environmental determinants of IRF consumption among adolescent girls. Nonetheless, its validation is warranted in other contexts. Our results also reveal that, although Senegalese adolescent girls were aware of several benefits associated with daily IRF consumption, certain behavioural and control beliefs, as well as environmental factors, do not appear to be conducive to the adoption of the behaviour. The next step could be to use the questionnaire to investigate relationships between the daily consumption of IRF and its individual and environmental determinants.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/adolescents4020017/s1, File S1. Questionnaire on individual and environmental determinants of the consumption of iron-rich foods among adolescent girls.

Author Contributions: Conceptualization, M.S., S.B., N.B.L. and A.N.N.; Methodology, M.S., S.B., N.B.L. and A.N.N.; Software, J.B.D. and S.B.; Validation, S.B. and M.S.; Formal Analysis, S.B. and J.B.D.; Investigation, M.S., N.B.L. and E.H.M.T.; Resources, N.B.L., E.H.M.T. and M.S.; Data Curation, S.B.; Writing—Original Draft Preparation, S.B.; Writing—Review & Editing, J.B.D., M.S., A.N.N., N.B.L. and E.H.M.T.; Visualization, M.S.; Supervision, M.S.; Project Administration, M.S., N.B.L. and E.H.M.T.; Funding Acquisition, M.S. All authors have read and agreed to the published version of the manuscript.

Funding: This study received the financial support from the Conseil National de Développement de la Nutrition/CNDN of Senegal.

Institutional Review Board Statement: This study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving research study participants were approved by the Comité national de la recherché en santé du Sénégal (#0000344/MSAS/CNERS/SP).

Informed Consent Statement: Informed consent/assent was obtained from all participants. Verbal consent was witnessed and formally recorded. Participation was voluntary and participants can withdraw from the study at any time without negative consequences or prejudice as well as without justifying their decision.

Data Availability Statement: Data available on request due to restrictions e.g., privacy.

Conflicts of Interest: The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

References

1. The Global Prevalence of Anaemia in 2011. Available online: https://apps.who.int/iris/handle/10665/177094 (accessed on 10 November 2023).
2. Anaemia 2023. Available online: https://www.who.int/health-topics/anaemia (accessed on 10 November 2023).
3. Stevens, G.A.; Paciorek, C.J.; Flores-Urrutia, M.C.; Borghi, E.; Namaste, S.; Wirth, J.P.; Suchdev, P.S.; Ezzati, M.; Roher, F.; Flaxman, S.R.; et al. National, regional, and global estimates of anaemia by severity in women and children for 2000–2019: A pooled analysis of population-representative data. *Lancet Glob. Health* **2022**, *10*, e627–e639. [CrossRef] [PubMed]
4. WHO. *Comprehensive Implementation Plan on Maternal, Infant and Young Child Nutrition*; World Health Organization: Geneva, Switzerland, 2023. Available online: https://apps.who.int/iris/handle/10665/113048 (accessed on 25 November 2023).
5. United Nations General Assembly. *Global Indicator Framework for the Sustainable Development Goals and Targets of the 2030 Agenda for Sustainable Development (E/CN.3/2020/2)*; United Nations General Assembly: New York, NY, USA, 2020. Available online: https://unstats.un.org/sdgs/indicators/Global%20Indicator%20Framework%20after%202022%20refinement_Eng.pdf (accessed on 25 November 2023).
6. Wirth, J.P.; Woodruff, B.A.; Engle-Stone, R.; Namaste, S.M.; Temple, V.J.; Petry, N.; Macdonald, B.; Suchdev, P.S.; Rohner, F.; Aaron, G.J. Predictors of anemia in women of reproductive age: Biomarkers reflecting inflammation and nutritional determinants of anemia (BRINDA) project. *Am. J. Clin. Nutr.* **2017**, *106* (Suppl. 1), 416S–427S. [CrossRef] [PubMed]
7. Petry, N.; Olofin, I.; Hurrell, R.F.; Boy, E.; Wirth, J.P.; Moursi, M.; Donahue Angel, M.; Rohner, F. The proportion of anemia associated with iron deficiency in low, medium, and high Human Development Index countries: A systematic analysis of national surveys. *Nutrients* **2016**, *8*, 693. [CrossRef]
8. WHO. *Accelerating Anaemia Reduction: A Comprehensive Framework for Action*; World Health Organization: Geneva, Switzerland, 2023. Available online: https://www.who.int/publications/i/item/9789240074033 (accessed on 25 November 2023).
9. Norris, S.A.; Frongillo, E.A.; Black, M.M.; Dong, Y.; Fall, C.; Lampl, M.; Liese, A.D.; Naguib, M.; Prentice, A.; Rochat, T.; et al. Nutrition in adolescent growth and development. *Lancet* **2022**, *399*, 172–184. [CrossRef]
10. Hargreaves, D.; Mates, E.; Menon, P.; Alderman, H.; Devakumar, D.; Fawzi, W.; Greenfield, G.; Hammoudeh, W.; He, S.; Lahiri, A.; et al. Strategies and interventions for healthy adolescent growth, nutrition, and development. *Lancet* **2022**, *399*, 198–210. [CrossRef] [PubMed]
11. Lassi, Z.S.; Moin, A.; Das, J.K.; Salam, R.A.; Bhutta, Z.A. Systematic review on evidence-based adolescent nutrition interventions. *Ann. N. Y. Acad. Sci.* **2017**, *1393*, 34–50. [CrossRef] [PubMed]
12. Godin, G. L'éducation pour la santé: Les fondements psycho-sociaux de la définition des messages éducatifs. *Sci. Soc. Et Santé* **1991**, *9*, 67–94. [CrossRef]
13. Akpaki, K.; Galibois, I.; Blaney, S. Measuring and predicting intention of Senegalese mothers to provide iron-rich foods to their children. *Int. J. Child Health Nutr.* **2021**, *10*, 88–104. [CrossRef]
14. Ninamou, N.R.; Dupuis, J.B.; Zagré, N.M.; Daffé, M.; Blaney, S. A tool to assess underlying factors to water provision among Guinean children. *Matern. Child Nutr.* **2021**, *18*, e13249. [CrossRef]

15. Sall, N.S.; Bégin, F.; Dupuis, J.B.; Bourque, J.; Menasria, L.; Main, B.; Vong, L.; Hun, V.; Raminashvili, D.; Chea, C.; et al. A measurement scale to assess responsive feeding among Cambodian young children. *Matern. Child Nutr.* **2020**, *16*, e12956. [CrossRef]
16. Tabachnik, B.G.; Fidell, L.S. *Using Multivariate Statistics*, 6th ed.; Pearson Education: Boston, MA, USA, 2013.
17. Comrey, A.L.; Lee, H.B. *A First Course in Factor Analysis*, 2nd ed.; L. Erlbaum Associates: Hillsdale, NJ, USA, 1992.
18. Field, A.P. *Discovering Statistics Using IBM SPSS Statistics*, 5th ed.; Sage Publication: Sussex, UK, 2018.
19. Croft, T.N.; Marshall, A.M.J.; Allen, C.K. *Guide to DHS Statistics*; ICF: Rockville, MD, USA, 2018. Available online: https://dhsprogram.com/data/Guide-to-DHS-Statistics/index.cfm (accessed on 5 May 2023).
20. Ajzen, I. The theory of planned behavior. *Organ. Behav. Hum. Decis. Process.* **1991**, *50*, 179–211. [CrossRef]
21. Ajzen, I.; Madden, T.J. Prediction of goal-directed behavior: Attitudes, intentions, and perceived behavioral control. *J. Exp. Soc. Psychol.* **1986**, *22*, 453–474. [CrossRef]
22. Godin, G. *Les Comportements Dans le Domaine de La Santé: Comprendre Pour Mieux Intervenir*; Les Presses de l'Université de Montréal: Montréal, QC, Canada, 2012.
23. Gagné, C.; Godin, G. *Les Théories Sociales Cognitives: Guide Pour la Mesure des Variables et le Développement de Questionnaires*; Groupe de Recherche sur les Aspects Psychosociaux: Québec, QC, Canada, 1991.
24. Krueger, R.A.; Casey, M.A. *Focus Groups: A Practical Guide for Applied Research*, 4th ed.; Sage Publication: Los Angeles, CA, USA, 2009.
25. Pałkowska-Goździk, E.; Zadka, K.; Rosołowska-Huszcz, D. Impact of the family environment on the frequency of animal-based product consumption in school-aged children in Central Poland. *Nutrients* **2023**, *15*, 2781. [CrossRef]
26. Agaba, M.; Azupogo, F.; Brouwer, I.D. Maternal nutritional status, decision-making autonomy and the nutritional status of adolescent girls: A cross-sectional analysis in the Mion District of Ghana. *J. Nutr. Sci.* **2022**, *11*, e97. [CrossRef]
27. Fentie, K.; Wakayo, T.; Gizaw, G. Prevalence of anemia and associated factors among secondary school adolescent girls in Jimma Town, Oromia Regional State, Southwest Ethiopia. *Anemia* **2020**, *2020*, 5043646. [CrossRef]
28. Montaño, D.E.; Kasprzyk, D. Theory of reasoned action, theory of planned behavior, and the integrated behavioral model. In *Health Behavior: Theory, Research, and Practice*, 4th ed.; Glanz, K., Rimer, B.K., Viswanath, K.V., Eds.; Jossey-Bass/Wiley: San Francisco, CA, USA, 2015; pp. 95–124.
29. Agence Nationale de la Statistique et de la Démographie (ANSD) [Sénégal]; ICF. *Sénégal: Enquête Démographique et de Santé Continue (EDS-Continue 2019)*; ANSD & ICF: Rockville, MD, USA, 2019.
30. IBM Corp. *IBM SPSS Statistics for Mac (Version 28.0) [Computer Software]*; IBM Corp: Armonk, NY, USA, 2021.
31. Muthén, B.O.; Muthén, L.K. *Mplus User's Guide (Version 8): Statistical Analysis with Latent Variables*; Muthén & Muthén: Los Angeles, CA, USA, 2017. Available online: https://www.statmodel.com/HTML_UG/introV8.htm (accessed on 9 October 2023).
32. Stevens, J. *Applied Multivariate Statistics for the Social Sciences*, 4th ed.; Pearson Education: Boston, MA, USA, 2002.
33. Caron, P.-E. *La Modélisation par Équations Structurelles avec Mplus*; Presses de l'Université du Québec: Québec, QC, Canada, 2018.
34. Gana, K.; Broc, G. *Structural Equation Modeling with Lavaan*; John Wiley & Sons Inc.: London, UK, 2019.
35. Byrne, B.M. *Structural Equation Modeling with MPlus: Basic Concepts, Applications, and Programming*, 1st ed.; Routledge: London, UK, 2012.
36. Hancock, G.R.; Muller, R.O. Rethinking construct reliability within latent variable systems. In *Structural Equation Modeling: Present and Future: A Festschrift in Honor of Karl Jöreskog*; Scientific Software International: Lincolnwood, IL, USA, 2001.
37. Flora, D.B.; Curran, P.J. An empirical evaluation of alternative methods of estimation for confirmatory factor analysis with ordinal data. *Psychol. Methods* **2004**, *9*, 466–491. [CrossRef]
38. Maydeu-Olivares, A.; Joe, H. Assessing approximative fit in categorical data analysis. *Multivar. Behav. Res.* **2004**, *49*, 305–328. [CrossRef]
39. Jansen, E.; Williams, K.E.; Mallan, K.M.; Nicholson, J.M.; Daniels, L.A. The feeding practices and structure questionnaire (FPSQ-28): A parsimonious version validated for longitudinal use from 2 to 5 years. *Appetite* **2016**, *100*, 172–180. [CrossRef]
40. Alami, A.; Tavakoly Sany, S.; Lael-Monfared, E.; Ferns, G.A.; Tatari, M.; Hosseini, Z.; Jafari, A. Factors that influence dietary behaviour toward iron and vitamin D consumption based on the theory of planned behavior in Iranian adolescent girls. *Nutr. J.* **2019**, *18*, 8. [CrossRef]
41. Lee, J.; Pelto, G.H.; Habicht, J.P.; Bhuiyan, M.M.I.; Chowdhury, S.J. Identifying nutrition and health-relevant behaviors, beliefs, and values of school-going adolescent girls in rural Bangladesh: Context for interventions. *Curr. Dev. Nutr.* **2019**, *3*, nzz013. [CrossRef]
42. Fleming, C.A.K.; Hockey, K.; Schmied, V.; Third, A.; De Oliveira, J.D.; Lala, G.; Theakstone, G. *Food and Me. How Adolescents Experience Nutrition across the World. A Companion Report to The State of the World's Children 2019*; Western Sydney University and United Nations Children's Fund: Sydney, Australia, 2020. [CrossRef]
43. Janha, R.E.; Hardy-Johnson, P.; Kehoe, S.H.; Mendy, M.B.; Camara, I.; Jarjou, L.; Ward, K.; Moore, S.E.; Fall, C.; Barker, M.; et al. Exploring influences on adolescent diet and physical activity in rural Gambia, West Africa: Food insecurity, culture and the natural environment. *Public Health Nutr.* **2021**, *24*, 5277–5287. [CrossRef] [PubMed]
44. Reese-Masterson, A.; Murakwani, P. Assessment of adolescent girl nutrition, dietary practices and roles in Zimbabwe. *Field Exch.* **2016**, *52*, 113. Available online: www.ennonline.net/fex/52/adolescentgirlnutrition (accessed on 27 November 2023).

45. Tumilowicz, A.; Pelto, G.H. Interventions to improve dietary intake behaviors among children and adolescents. *Glob. Food Secur.* **2020**, *27* (Suppl. 2), 100413S. [CrossRef]
46. Marras, S.; Salmivaara, M.; Bendech, M.; Seki, R. *Urban Food Systems, Food Security and Nutrition in Dakar, Senegal*; The United Nations Food and Agriculture Organization: Dakar, Senegal, 2016. Available online: https://www.academia.edu/37801223/Urban_food_systems_food_security_and_nutrition%20in_Dakar_Senegal (accessed on 25 November 2023).