

Title page

The title of the article: Photographic methods for measuring packaged food and beverage products in supermarkets^{i,ii,iii,iv}

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ⁱ There are no data repositories for this work and thus, no links to data repositories

ⁱⁱ List of abbreviations: NCD: non-communicable disease, WHO: World Health Organization, INFORMAS: International Network for Food and Obesity / non-communicable Diseases Research, Monitoring and Action Support, LAC: Latin American and Caribbean, INTA: Institute of Nutrition and Food Technology, ASACH: Association for Supermarkets, SES: socio-economic status

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1 **Abstract**

2 **Background:** The global obesity pandemic and nutrition-related non-communicable diseases
3 has increased worldwide, especially in the Latin American and Caribbean region. In an attempt
4 to control this obesity epidemic the Chilean government has established a comprehensive set of
5 regulatory actions including beverage taxation, warning labels on foods and marketing
6 restrictions to children. To improve effectiveness of actions to prevent obesity, a better
7 understanding of the food environment is needed.

8 **Objective:** We developed and standardized photographic methods to assess and monitor
9 packaged food and beverage products in supermarkets.

10 **Methods:** A standardized protocol and food categorization system was used to guide photo
11 collection and the data management of photos taken between February and April 2015. Eleven
12 supermarkets, consisting of five different supermarket chains, from high- (n = 6) and lower
13 middle (n = 5) income neighborhoods in Santiago, Chile. Photos (n = ~50,000) from nearly
14 10,000 unique food products from high- and lower-middle income neighborhoods were used for
15 this study.

16 **Results:** We developed standardized methods to utilize photographs to assess and monitor the
17 food environment. A food categorization scheme is essential to guiding the data collection
18 process. Substantial time and human resources are required to assess packed food and beverage
19 products in supermarkets. As the number of photos per food product is variable, the organization
20 of the photographs according to the food categorization system, prior to data entry, is imperative
21 for easy access during data entry and analysis. We identified the information necessary for a
22 photographic registry; that with the food categorization system are critical for creating unique
23 identifiers that are linked to each food product and its photos.

24 **Conclusions:** To adequately monitor food environments, standardized methods for food photo
25 collection and management are essential. The information collected on food package photos to
26 monitor food environments is important for guiding and evaluating actions in the context of the
27 ongoing obesity and non-communicable disease (NCD) epidemics.

28
29 **Keywords:** Food environment, photographic methods, INFORMAS, Chile

30 31 **Introduction**

32 The global obesity pandemic and nutrition-related non-communicable diseases continue to
33 increase worldwide (1-5) . It is clear that more actions are required to halt these increases.
34 Accordingly, several bodies have called for urgent action to halt this pandemic, especially
35 regarding children; for example, the World Health Organization (WHO) has made childhood
36 overweight one of their global nutrition targets for 2025 (6-8) . There is now relative agreement
37 that dietary decisions do not only depend on individual characteristics but that they are also
38 importantly shaped by the environment. The food environment has been described in several
39 ways (9-11) . However, independently of the definition used there is agreement that in order to
40 define and improve effectiveness of actions to prevent obesity, there is a need to better
41 understand the food environment. That is equally important, if not more so, in shaping dietary
42 decisions. The need of monitoring the different aspects of the food environment has been
43 recently highlighted by the International Network for Food and Obesity / non-communicable
44 Diseases Research, Monitoring and Action Support (INFORMAS) (12, 13) .

45 Key aspects of the consumer-related food environment correspond to labeling of food
46 products that includes both the marketing strategies as well as food composition information

47 printed on the food label. Several agencies have promoted actions targeting these different
48 aspects of food labels such as decreasing the marketing of unhealthy foods for children, use of
49 traffic lights as warning labels of processed foods (7, 14, 15) ; as well as suggesting the
50 reformulation of the nutritional content, such as decreasing trans fats or sodium in processed
51 foods (16) . The existing methods that have been used to collect information based on food labels
52 are primarily based on survey methods (9) or by directly purchasing food products (17) . To the
53 best of our knowledge, while not yet reported on in the scientific literature, another way of
54 collecting the information contained on food labels is by taking photos of packaged food
55 products at supermarkets. From the beginning of our study design, photographic methods seemed
56 both less expensive and more feasible than conducting paper surveys or food product purchases
57 that have constraints to the printed page or literal storage space. Therefore, photographic
58 methods appeared to be a promising means to assess the consumer food environment. However,
59 this has to be done in a standardized way, following simple and replicable protocols that allow
60 for collecting valid and comparable information.

61 This is particularly relevant in the Latin American and Caribbean (LAC) region because the
62 LAC, compared to the other World Bank regions per their division of the world into six distinct
63 geographic regions, has the greatest prevalence of overweight and obesity in the world among
64 women (18) as well as a high consumption of energy-dense nutrient-poor foods that have been
65 indicated as one of the most important factors of overweight and obesity (19) . Chile, in
66 particular has a high prevalence of obesity amongst all age groups (11.05% < 6 y, 24.09% in
67 women) (20) . As an attempt to control this obesity epidemic the Chilean government has
68 established a comprehensive set of regulatory actions in Law 20.606, known as the Chilean Law
69 of Food Labeling and Advertising, including beverage taxation, warning labels on foods and

70 marketing restriction to children (21) . In this context, monitoring marketing strategies on
71 packages, food labeling and food composition becomes a key aspect of assessing the success of
72 the Chilean Law of Food Labeling and Advertising. Therefore, we developed a protocol for
73 collecting food photos at supermarkets within the capital of the country that concentrates about
74 50% of the total Chilean population. The aim of the present article is to describe the methods
75 developed for the photo collection and management of packaged food and beverage products and
76 present the subsequent resource needs, time and challenges encountered. We believe this
77 information will be useful for other countries of the region and worldwide to those interested in
78 monitoring these aspects of the consumer food environment.

79

80 **Methods**

81

82 *Neighborhood selection*

83 The capital city of Santiago, Chile was chosen as the primary study area as it encompasses the
84 largest proportion of the Chilean population. Santiago was also the most cost-effective area to
85 conduct the study because it is where our research institution (Institute of Nutrition and Food
86 Technology, INTA) is located. To be able to assess potential associations in the availability of
87 food and drink products by socio-economic status, neighborhoods were selected based on their
88 socio-economic status level as defined by the Chilean National Office of Statistics. However,
89 according to the most recent data no supermarket chains were located in neighborhoods that fell
90 into the poorest socio-economic category (22) . Therefore, only high- (n = 6), and lower-middle
91 income (n = 5) neighborhoods were selected for our study.

92

93 *Supermarket selection*

94 Supermarkets were selected as the source to collect data on food and drink items for this study
95 because they offer the greatest variety of ultra-processed food items in Chile and are one of the
96 primary sources of food provision (19) . Before identifying any supermarkets for inclusion in this
97 study, an agreement between the Chilean National Association for Supermarkets (ASACH) and
98 INTA, at the University of Chile, was reached. Based on the agreement, five of the six different
99 supermarket chains were included in the study; one chain declined to participate in the study.
100 One supermarket from each chain was selected in either a high- or lower-middle income
101 neighborhood. Except for one chain that does not have any locations in a lower-middle income
102 neighborhood within Santiago, Chile. After the agreement with the Chilean National Association
103 for Supermarkets was signed, each supermarket was selected for inclusion into the study based
104 on having the greatest variety of products per chain within each of the two neighborhood income
105 categories.

106

107 *Food and beverage selection*

108 Food and beverages to be included in the photo collection were selected based on the categories
109 that would be most affected by the Chilean Law of Labeling and Advertising based on expert
110 opinion from the George Institute's Food Policy group based on their extensive previous
111 experience in assessment of consumer food environments, globally. Ultra-processed food and
112 drink products were defined by following the NOVA food classification system to include all
113 food or drink products that are industrially manufactured, containing little or no whole food, and
114 being primarily those products that are ready-to-eat (19) . Taken together, eleven different food
115 categories were identified in which ultra-processed food labels would be collected: Drinks;

116 Bread and bakery products; Breakfast cereals; Sweets; Ready-to-eat foods; Meats; Fish and
117 seafood; Dairy products; Canned/preserved fruits and vegetables; Sauces/spreads; and Snack
118 foods. For each large food category, several subcategories were created depending on the large
119 food group (from one category in meats to 9 in beverages). Each of these food sub- categories
120 was then also sub-divided in another category that allow us to distinguish food
121 products/beverage most likely subject to the Chilean Law of Food Labeling and Advertising
122 because of addition of critical nutrients (sodium, sugar and saturated fats). As an example, in the
123 “beverages” category we had the subcategory of “sodas” that was then further divided into
124 “sodas without sugar” and “sodas with sugar”. Fieldworkers were given a spreadsheet with
125 various sub-categories listed under each of these larger food categories and were instructed to
126 take photographs of any processed foods within each sub-category (**Supplemental Table 1**).
127 The fieldworkers were also instructed to carefully read the ingredients when they were not sure
128 whether a food or beverage product was ultra-processed. To maximize the limited time available
129 for data collection as well as to avoid unnecessary duplicates, we decided to always take photos
130 of the largest package size for products in which more than one package size was available.
131 However, in the instances where the food product employed different marketing strategies
132 depending on the package size we took photos of all the sizes to capture the different marketing
133 strategies.

134

135 *Fieldworker training*

136 Four fieldworkers conducted the data collection for this study; three of the field workers were
137 nutritionists and one had a Master’s degree in Food Security. All fieldworkers received a two-
138 day classroom training on the overall INFORMAS network and framework; the Chilean Law of

139 Food Labeling and Advertising; and specific didactic training on the food composition, food
140 labeling and food promotion modules of the INFORMAS monitoring framework. In addition, all
141 fieldworkers received one day of photography training by a professional photographer; and a
142 half-day training of fieldwork in a supermarket (**Table 2**).

143

144 *Data collection and Quality Control*

145 *Materials*

146 To take photos of a food label, photographs were taken using two digital cameras (*Canon EOS*
147 *Rebel T3*) because they produce photos at a higher resolution than mobile devices. One battery
148 was included with each camera purchased. However, one extra battery was purchased for use
149 with each camera. All equipment used in this study is presented in **Table 1**.

150

151 Data collection was scheduled to take place during the summer holiday, specifically the month of
152 February, in Chile because supermarkets have less attendance in those months. Fieldwork was
153 pre-arranged to take place in each of the 11 supermarkets for on average two complete weekdays
154 (8 am to 5 pm). When possible, fieldwork was avoided on Mondays and Fridays, as they
155 constitute the two busiest weekdays at the supermarket (for new item reposition and greatest
156 attendance of customers, respectively). All fieldwork for this study was conducted between
157 February 2nd, 2015 and April 1st, 2015.

158

159 All fieldworkers were instructed to wear a lab coat, identification badge and closed-toed shoes in
160 the supermarket during data collection. Fieldworkers were instructed to give a standard response
161 if approached by customers (i.e. “*what we are doing is for a study about nutritional labeling*”).

162 Fieldworkers were paired into two teams of two and each team was assigned different food
163 categories for the duration of the study (Team A: Drinks; Sweets; Ready-to-eat food; Fish and
164 seafood; Canned/preserved fruits and vegetables; Sauces/spreads; Snacks; Team B: Bread and
165 bakery products; Breakfast cereals; Meats; and Dairy). Each team was instructed to take photos
166 with the digital camera of all faces of the food label; and was each given a check-list to double
167 check that photos visibly included the following aspects of the food label: the bar code, the
168 package shape, the volume or weight of the package, the nutrition information table and the
169 ingredients. Fieldworkers were instructed to take photos of as many processed food products that
170 they could within a given sub-category. It was sometimes the case that fieldworkers did not have
171 enough time to collect photos of all the products within a given sub-category in a supermarket
172 over the course of the two data collection days. In those cases, the coordinator assigned a total
173 time for each sub-category and each team was instructed to take as many photos of different
174 products as they could in accordance with the schedule provided and prioritize taking photos of
175 store brand products. The photos of store brand products were prioritized because store brand
176 products are unique to each chain; and a store from each chain was only visited one or two times
177 for a limited number of days. Therefore, if photos of a store brand product were not taken then
178 there might not exist another opportunity to capture photos of this product compared to a multi-
179 national brand product that is likely to be found at supermarkets linked to more than one chain.
180 Photos of the same product were taken when supermarkets were of different socioeconomic
181 status (i.e. for analyzing differences by socio-economic status, SES) but not in supermarkets
182 within the same SES level. In order to avoid taking photos of the same product (i.e. duplicating
183 photos), each day, the fieldworkers would put all the products photographed in a shopping cart
184 and then take a photo of the cart contents that could be reviewed to confirm whether a product

185 had been already photographed or not. The results presented later in this study are regarding the
186 approximately 10,000 food items that were photographed during the study.

187

188 *Quality Control*

189 Quality control was done at two levels. First, by the fieldworkers themselves in the moment of
190 data collection in which they could view on the camera and retake the photo if it was not clear
191 enough. Following each day of data collection, the field coordinator collected and reviewed all
192 photos for visibility and completeness. In general, reviewing the completeness of a product's
193 photos meant making sure that the product's photos included pictures with all sides of the
194 product, the bar code, all of the ingredients, the nutrition facts table, and the net content of the
195 product; and were not partially obstructed after taking into account all the photos associated with
196 a product. Then, the field coordinator emailed all field workers with a powerpoint presentation
197 with the identified low-quality photos so that the field workers could re-take the selected low-
198 quality photos the next day in the same or a different supermarket. Regular meetings were also
199 held between field workers and the field coordinator to discuss questions (e.g. what new products
200 encountered were or were not included in a particular sub-category) or problems encountered
201 taking photos, for example if a product was difficult to photograph. At the completion of each
202 day of fieldwork, it was quickly determined that all photos had to be stored on an external hard
203 drive due to their large file size. Yet, what was previously not anticipated was that it would be
204 necessary to have a daily meeting with fieldworkers to discuss questions or problems
205 encountered during fieldwork as well as to perform a daily review of all the photos taken in order
206 to uphold the quality in the database being collected.

207

208 *Data management*

209 After data collection was complete, the following basic information about each product
210 pertaining to a photo or set of photos was entered into an Excel spreadsheet: the date the photo(s)
211 was taken; the name of the product; the sub-category to which the product pertains; the bar code
212 number of the product; the factory that made the product; the elaboration date of the product (if
213 applicable); the expiration date of the product (if applicable); the number of photos in the
214 database that pertain to the given product; and any observations related to the product, such as
215 “the expiration date is 18 months from the elaboration date of the product”. Based on these
216 characteristics, this information was used to determine that products were unique from each other
217 and not duplicates. After determining the unique, individual, products in the database a unique
218 ID for each product was created in STATA version 12.0 SE (College Station, TX). The unique
219 ID itself is based on our, previously described, three-level food classification system that
220 consisted of 11 large food groups that in total were composed of 53 general food subcategories
221 that were further divided into a second subcategory level (186 in total) (**Supplemental Table 1**).
222 Each food category and subcategory was assigned two numerical digits. The combination of the
223 two digits for each food categorization level (food group, subcategory 1, subcategory 2)
224 composed the first part of the unique ID; and then programming was used to count the number of
225 unique products within each specific subcategory (subcategory 2). For example, the first juice
226 concentrate product would have the unique ID 101011; 1 to represent the beverage category, 01
227 to represent the subcategory “Fruit and Vegetable Juices”, 01 to represent the second
228 subcategory of “juice concentrates”, and finally 1 to represent the first juice concentrate product
229 in the database. This unique ID becomes part of a larger photo file name; whereby we decided
230 that is important to also include the date, store code, and photo number in the series of photos

231 associated with the product. For example: 101011_020215_1_1.JPG, 101011_020215_1_2.JPG
232 101011_020215_1_3.JPG, 101011_020215_1_4.JPG. Such that 101011 is the unique ID
233 (consecutive within each food subcategory), 020215 the photo date, 1 the store code and the final
234 digit (before .jpg) represents if there is more than one photo of each product in a consecutive
235 order per product.

236

237 **Results**

238 Overall, on each day of fieldwork, one percent of the photos ($n = 10$) or less was classified as
239 missing or hard to read that the field workers were subsequently asked to retake. In addition to
240 multiple full weekdays needed to conduct the photo collection, a main result of this study was
241 learning that substantial time after each day of fieldwork is necessary for the preparation of the
242 subsequent day of fieldwork in order to maintain the representativeness in the sample strategy as
243 well as database quality. Specifically, by making agendas (15 min / d), having a daily meeting (1
244 hr / d), daily photo back-up (.5 hr / d), and daily review of all the photos collected (3 hr / d)
245 (**Table 3**). A main finding from this study was that a couple of data collection days in a
246 supermarket do not provide enough time for two fieldworkers to collect photos of all the
247 different products in a large food category. And therefore, consequently, it was important to
248 design daily fieldworker agendas to guide data collection of at least a few products per
249 subcategory to maintain the representativeness of the study sample. Furthermore, the limited
250 time in each supermarket made apparent that certain types of food products should be prioritized
251 in the data collection process, such as store brand products and imported products that may only
252 be found in one particular supermarket. On average, each team took 1,000 photos on each day of
253 fieldwork. Based on the metadata of each photo file it was estimated that teams took on average

254 one minute or less to photograph a given product's food label in its entirety. A total of 10,000
255 products were collected amongst all SES levels (~50,000 photos).

256

257 The data entry to complete the basic information registry of the photographic database took
258 approximately 576 hours (**Table 4**). With each product having a unique ID, each photo file was
259 subsequently renamed with the unique ID of the product followed by the date that the photo was
260 taken, the supermarket code, and the number of the photo in the product series; this process took
261 approximately 840 hours for the high-income neighborhoods (**Table 4**). After all photo files
262 were renamed with unique identifiers, the basic information registry database was again checked
263 for duplicate entries in the case that photos of the same product were inadvertently collected on
264 another day of field work. The basic information registry database was also reviewed to ensure
265 that all products pertained to the correct subcategory. If not, the database was appropriately
266 revised. For example, if a diet soda was listed as a sugar-sweetened soda by mistake. Overall,
267 approximately 2% of products were found to be duplicates and erased from the database (n =
268 201); and approximately 2% of products (n =201) were misclassified and assigned a new unique
269 ID to reflect the right subcategory to which the product pertained.

270

271 **Discussion**

272 The present study aimed to describe the process to collect food photos to study both
273 public and private actions related to food labeling and marketing and thus, further the
274 understanding of the food environment. To the best of our knowledge, this is the first effort to
275 systemize photographic methods for the comprehensive study of food labeling and marketing of
276 food packages. Compared to paper surveys or a more limited selection of purchased food

277 packages, permanent digital photo files ensure that longitudinal follow-up as well as
278 retrospective analyses are possible. An example of a retrospective analysis that could be
279 performed based on the photos collected is regarding food and beverage package characteristics
280 by food category, such as package shape, package weight or volume, and package ingredient and
281 nutrition information that are equally useful for evaluating regulations similar to that of the
282 Chilean Law of Food Labeling and Advertising during any stage or phase of regulation. Thus,
283 the photographic data collection of food and beverage products is extremely pertinent and
284 relevant for monitoring, and subsequently, evaluating the implementation of packaged food and
285 beverage regulations, such as the Chilean Law of Food Labeling and Advertising. Furthermore,
286 we will utilize the photographs collected in this study to assess the impact of the Chilean Law of
287 Food Labeling and Advertising in terms of marketing strategies including front-of-package
288 labeling and reformulation. Also, it is less expensive and more feasible to attain a greater study
289 sample of foods by collecting data through photographic methods than it is through the purchase
290 of individual food products for subsequent analysis. Based on our experience, we identified a
291 few aspects that we believe need to be solved before, during, and after the process of photo
292 collection to ensure its quality. Before starting the data collection, it is important to define the
293 sampling strategy of food products and of supermarkets. Specifically, how and which food
294 groups will be selected for data collection; the selection of package sizes regarding products in
295 which more than one size, and often many sizes, are available; and ultimately, the number of
296 individual unique food products that should be sampled. The number of products that can be
297 photographed will of course depend on the economic and human resources available but in
298 thinking about the sampling strategy of food products, one may want to consider collecting the
299 most highly consumed foods (ideally based on representative dietary data or sales data (market

300 share)) in a given country or in a subgroup of interest (e.g. children or adolescents) or collecting
301 photos in food categories subject to current or potential regulations related to packaged foods
302 (e.g. high in trans fatty acids, sugars, etc.). It is also important to carefully think through the
303 sampling strategy of the stores from the food environment to include in the study sample. A first
304 consideration should be made as to the degree of representativeness desired regarding store type.
305 One strategy may be to represent the different types of stores (mega markets, supermarkets,
306 convenience stores, kiosks, etc.) in the study sample. Another strategy may be the one used in
307 our study to compile a study sample that represents the various supermarket chains. While
308 another option is to use a convenience sample of supermarkets to achieve the desired sampling
309 strategy of food products. Depending on what strategy is used to determine the stores that make
310 up the study sample, an inherent trade off may exist between store type variety and product
311 variety. In the case of our study, a clear limitation is that while we tried to maximize product
312 variety by going only to large supermarkets, we have potentially missed products that are unique
313 to other store types such as convenience stores, kiosks, and candy shops.

314 Before going into the field, it is also important to carefully identify and train the people in
315 charge of taking the photos. We believe that it is not required that those taking the photos be
316 nutritionists, as was the case in our study, but some training in human nutrition or food science is
317 useful for a better understanding of what categories those can take photos from; which may
318 result in greater work efficiency during data collection and management. As a challenge during
319 the photo collection was agreeing on the food categorization. This may be more difficult for
320 some food subgroups (e.g. dairy products). Therefore, it may be faster for people with some
321 nutrition background to know what food classification they are working with and to complete the
322 basic information registry following data collection. Additional fieldworker training was

323 necessary to understand what foods pertained to certain subcategories, especially regarding dairy
324 products, marinated frozen whole chicken, spreadable icing, preserved fruit with sugar added, the
325 different instant soups (e.g. powdered versus cup-of-noodles), the difference between butter and
326 margarine; and the differences between cracker types (sweet, salty, whole grain, soda). There are
327 many different ways in which foods may be classified. It is recommended to decide what food
328 categorization scheme will be used prior to beginning data collection so that the fieldworkers can
329 be properly trained following this scheme to help minimize errors during data collection as well
330 as data management. A limitation of our study is that our photographic experience and
331 subsequent data collection was restricted to only the food labeling aspect of the consumer food
332 environment. Other aspects of the consumer food environment such as food availability, food
333 affordability, food accessibility and food marketing within a store need to be collected if a more
334 comprehensive assessment of healthy diets is intended either for monitoring or evaluation
335 purposes.

336 We also experienced some difficulties during the process of photo collection. The
337 primary difficulty was that although individual agreements were obtained prior to data collection
338 to conduct fieldwork during pre-arranged dates and times for each supermarket, the fieldworkers
339 still encountered some problems in entering supermarkets (i.e. local manager had not been
340 informed or was away) that slightly delayed the data collection. During the process of photo
341 collection, we also found that there were food packages especially difficult to photograph in a
342 supermarket with poor lighting and that therefore, resulted in photos of poor quality. Food
343 packages that were particularly difficult to photograph include: extremely large packages (e.g.
344 multipacks of 3 L sodas), packages with extremely small printed text, shiny packages, packages
345 in irregular shapes (e.g. large bags; cylindrical packages of cookies), packages with excessive

346 contrast, packages that contain multiple individual items (e.g. multiple drinkable yogurts),
347 transparent packaging, packages that have a plastic top over a paper or metallic cover with
348 information that may or may not be visible underneath (e.g. margarine tubs), and additional
349 labeling stickers placed over the food label (e.g. imported products). The photographic quality of
350 sausages and other processed meat products can be often limited due to possessing a number of
351 these characteristics. To ensure quality of photos collected in this study we used professional
352 level digital cameras. It is possible to work with a less expensive digital camera. However, it is
353 essential that the digital camera have a “Macro” setting that can be set by the user (i.e. not
354 through the automatic detection by the camera). Battery life is also important to check prior to
355 data collection. We only utilized back-up batteries after 8 hours of continuous work. However,
356 some less expensive cameras may include batteries with a shorter lifespan; for example, a
357 duration of two hours during continuous work. Therefore, to achieve sound data collection on a
358 daily basis requires not just the photographic data collection itself in a store setting, but work
359 before and after the data collection itself.

360 Another critical aspect relates to the managing of the photos once they have already been
361 collected. Photos accumulate in file folders with random file names that may be repeated (e.g.
362 IMG_1517.JPG) and the fact that more than one photo is often associated with one product. For
363 example to capture the image of a cereal box often at least six photos are needed. When more
364 than one camera is used in a study, the automatic photo file names given by a camera repeat (e.g.
365 a study with two cameras both could give the file same name, for example: IMG_1517.JPG, even
366 though each camera took a photo of a product different from the other). Based on our experience
367 in Chile, the same barcode can be seen on a different type of product in as little time as one
368 month. Taken together, it is important to re-name each photo file so that photo files of the same

369 name do not accidentally replace photo files with the same name. In Chile, we decided that it
370 was important to apply a systematic data labeling and management system to the creation of
371 unique IDs for the food products, so that the product for its photos could be more easily
372 identified later on. This means that following data collection the following basic information
373 (year, food subcategory, photo(s) date, store code, product name that includes brand name,
374 product description, package type, and package size, barcode, factory, and number of photos
375 associated with a product) was entered into a registry used to create a unique ID, similar to how
376 socio-demographic characteristics of a person might be used to create a unique personal
377 identifier in a large national household survey. Each subcategory of foods in which food or
378 beverage product photos were collected during the study was assigned a unique subcategory
379 code (analogous to how a zip code is used to define a given small area); and then programming is
380 used to count the number of food products in the basic registry that are included within each
381 subcategory. It is from this composite that a unique ID is created for each unique individual
382 product that has had photos taken.

383 We therefore recommend the use of a basic information registry to aid in the designation
384 of unique IDs to each unique product and the subsequent re-naming of each photo file. We
385 recognize that this is a time consuming process, but believe that the time to create IDs and re-
386 name each photo file is less than the time that would accumulate if one had to look through
387 thousands and thousands of photo files to find the product(s) of interest during the data entry and
388 data analysis phases of this work. With the basic information registry as well as by unique ID is
389 possible to quickly identify each product and its associated photos. Furthermore, if file folders
390 are created based on the food subcategories used to create IDs for the photos, assuming the re-

391 named photos are moved to these folders, it is very easy to find a particular photo set based on
392 just the unique product ID at a later stage.

393 In conclusion, to adequately monitor the consumer food environment in Chile and to
394 assess the impact of the Chilean Law of Food Labeling and Advertising we developed a simple,
395 standardized method for food photo collection and management to aid subsequent data entry and
396 analysis. Our overall conclusion is that it is relevant to share this type of protocol to advance in
397 the standardization of field methods what will enable, in turn, the collection of standardized data
398 to carry out valid food environment comparisons within and between countries. As global
399 research teams and other entities implement photographic methods to assess the consumer food
400 environment, especially regarding food and beverage products, we strongly recommend that data
401 repositories be established to facilitate historical reference as well as data sharing to support
402 within and between country consumer food environment comparisons. The information collected
403 on food package photos is key for monitoring food environments and therefore, guiding and
404 evaluating actions in the context of the ongoing obesity and NCD epidemics.

405

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412

413 *Statement of authors' contributions to the manuscript:* R.K., M.R. and C.C. formulated the
414 research questions and designed the study. R.K carried out the study and analyzed the data. R.K.
415 was responsible for writing the article. M.R. and C.C. made revisions to the article. R.K., M.R.
416 and C.C. all read and approved the final manuscript.

References

1. Finucane MM, Stevens GA, Cowan MJ, Danaei G, Lin JK, Paciorek CJ, Singh GM, Gutierrez HR, Lu Y, Bahalim AN, et al. National, regional, and global trends in body-mass index since 1980: systematic analysis of health examination surveys and epidemiological studies with 960 country-years and 9.1 million participants. *Lancet* 2011;377:557-67.
2. Feigin VL, Roth GA, Naghavi M, Parmar P, Krishnamurthi R, Chugh S, Mensah GA, Norrving B, Shiue I, Ng M. Global burden of stroke and risk factors in 188 countries, during 1990–2013: a systematic analysis for the Global Burden of Disease Study 2013. *The Lancet Neurology* 2016;
3. Singh GM, Micha R, Khatibzadeh S, Lim S, Ezzati M, Mozaffarian D, Global Burden of Diseases Nutrition and Chronic Diseases Expert Group (NutriCoDE). Estimated Global, Regional, and National Disease Burdens Related to Sugar-Sweetened Beverage Consumption in 2010. *Circulation* 2015;132:639-66.
4. Wang Q, Afshin A, Yakoob MY, Singh GM, Rehm CD, Khatibzadeh S, Micha R, Shi P, Mozaffarian D, Global Burden of Diseases Nutrition and Chronic Diseases Expert Group (NutriCoDE). Impact of Nonoptimal Intakes of Saturated, Polyunsaturated, and Trans Fat on Global Burdens of Coronary Heart Disease. *J Am Heart Assoc* 2016;5:10.1161/JAHA.115.002891.
5. Arnold M, Pandeya N, Byrnes G, Renehan AG, Stevens GA, Ezzati M, Ferlay J, Miranda JJ, Romieu I, Dikshit R. Global burden of cancer attributable to high body-mass index in 2012: a population-based study. *The Lancet Oncology* 2015;16:36-46.
6. WHO. Global Targets 2025. Internet: <http://www.who.int/nutrition/global-target-2025/en/> (accessed 08/09 2016).
7. Pan American Health Organization (PAHO). Plan of Action for the Prevention of Obesity in Children and Adolescents. Pan American Health Organization, 2015.
8. IOM (Institute of Medicine). Accelerating Progress in Obesity Prevention: Solving the Weight of the Nation. Washington, D.C.: The National Academies Press, 2012.
9. Glanz K, Sallis JF, Saelens BE, Frank LD. Nutrition environment measures survey in stores (NEMS-S). *Am J Prev Med* 2007;32:282-9.
10. McKinnon RA, Reedy J, Lytle LA, Yaroch AL. Measures of the food environment: a compilation of the literature, 1990–2007. *Am J Prev Med* 2009;36:S124-33.
11. Caspi CE, Sorensen G, Subramanian SV, Kawachi I. The local food environment and diet: a systematic review. *Health Place* 2012;18:1172-87.

12. INFORMAS. Welcome to INFORMAS. Internet: <https://www.fmhs.auckland.ac.nz/en/soph/global-health/projects/informas.html> (accessed 08/09 2016).
13. Swinburn B, Sacks G, Vandevijvere S, Kumanyika S, Lobstein T, Neal B, Barquera S, Friel S, Hawkes C, Kelly B. INFORMAS (International Network for Food and Obesity/non-communicable diseases Research, Monitoring and Action Support): overview and key principles. *Obesity Reviews* 2013;14:1-12.
14. Pan American Health Organization. Nutrient Profile Model. Washington, DC: PAHO, 2016.
15. WHO. Technical meeting on nutrition labelling for promoting healthy diets. Internet: http://www.who.int/nutrition/events/2015_meeting_nutrition_labelling_diet_9to11dec/en/ (accessed 08/09 2016).
16. World Health Organization. Global action plan for the prevention and control of noncommunicable diseases 2013-2020. Geneva, Switzerland: WHO Press, 2013.
17. Chacon V, Letona P, Barnoya J. Child-oriented marketing techniques in snack food packages in Guatemala. *BMC Public Health* 2013;13:967.
18. Ng M, Fleming T, Robinson M, Thomson B, Graetz N, Margono C, Mullany EC, Biryukov S, Abbafati C, Abera SF. Global, regional, and national prevalence of overweight and obesity in children and adults during 1980–2013: a systematic analysis for the Global Burden of Disease Study 2013. *The Lancet* 2014;384:766-81.
19. Pan American Health Organization. Ultra-processed food and drink products in Latin America: Trends, impact on obesity, policy implications. Washington, DC: PAHO, 2015.
20. Ministerio de Salud: Subsecretaria de Salud Pública. VIGILANCIA DEL ESTADO NUTRICIONAL DE LA POBLACIÓN BAJO CONTROL Y DE LA LACTANCIA MATERNA EN EL SISTEMA PÚBLICO DE SALUD DE CHILE. Ministerio de Salud, 2015.
21. MINISTERIO DE SALUD, SUBSECRETARÍA DE SALUD PÚBLICA. Ley 20606. Internet: <https://www.leychile.cl/Navegar?idNorma=1041570> (accessed 08/09 2016).
22. Adimark. MAPA SOCIOECONÓMICO DE CHILE. Nivel socioeconómico de los hogares de país basado en datos del Censo. Adimark,

Table 1: Equipment and human resources needed to carry out the different stages of food labeling and advertising data collection, data management and data entry

Human resources				Equipment needed					
PHASE	Team Leader	Field workers (fw)		Permissions or Protocols	Digital Cameras	Camera supplies		Extra Supplies	Space
		At least	Extra Personnel			Extra	Extra		
Fieldwork training for data collection	Fieldwork Coordinator	At least $4 \leq 4+n$	1 Photographer	Permission to do a half-day training simulation in a supermarket	at least 1 camera per team of 2 fieldworkers				Room with projector to give presentations
Data (photo) collection	Fieldwork Coordinator	At least $4 \leq 4+n$		Written agreement between supermarket(s) and academic institution	at least 1 camera per team of 2 fieldworkers	Extra camera (1 / camera);	Labcoat (1 / fw), rubber gloves (per day), credential with photo (1 /		Supermarkets

					32 GB	fw), copy of
					memory	agreement (1 /
					card (1 /	fw); external
					camera)	hard drives (1
						TB) (at least 2,
						1 for daily use
						and 1 as
						exclusive
						backup)
	Data	At	1	Protocol: data	16 GB USB	Personal
	Manager	least	Assistant	management (re-	memory stick	computers
Data	(same or	$4 \leq 4+n$	data	naming photo files)	(1 / fw);	with access
Managem	different as	, same	manager		external hard	to REDCap
ent	fw	or			drives from	platform;
	coordinator)	differe			previous phase;	online (free)
		nt as			REDCap	forum

		fw				platform (backup: Excel); STATA
Data	At	1	Protocol: data entry		16 GB USB	Personal
Manager	least	Assistant	("Basic Excel";		memory stick	computers
(same or	$4 \leq 4+n$	data	Platform		(1 / fw);	with access
different as	, same	manager	Nutrients/Portion		external hard	to REDCap
Data	fw	or	information/Ingredien		drives from	platform;
Entry	coordinator)	differe	ts)		previous phase;	online (free)
		nt as			REDCap	forum
		fw			platform	
					(backup: Excel); STATA	

Table 2: Tasks and estimated time associated with each task, needed to carry out the fieldwork training necessary for data collection regarding the Chilean Law of food labeling and advertising

Phase: fieldwork training for data collection*		
Task	Responsible	Estimated time
Training with designated fieldworker coordinator about all the subsequent training and work required for data collection	Principal and/or co-investigators; Fieldwork coordinator	8 hrs
Presentation: General introduction	Principal and/or co-investigators	1 hr
Presentation: Introduction to data collection in the field	Fieldwork coordinator	2.5 hrs
Presentation: Introduction to photography of food packages	Fieldwork coordinator	.5 hr
Practical session: Photography of food packages in controlled (institution) setting	Fieldwork coordinator with fieldworkers	2.5 hrs
Recommended practical session: Advanced photography training with a professional or highly experienced photographer (<i>optional depending on</i>	Professional or highly experienced photographer;	5-6 hrs

<i>how professional the camera is)</i>	fieldworkers	
Optional weekend practice: fieldworkers practice taking food package photos at home	Fieldworkers	3 d
Practical session: half-day training simulation in a supermarket	Fieldwork coordinator with fieldworkers	4 hrs

*Prior to training it is important to obtain an agreement with desired supermarkets and/or other food establishments, which could take at least two months

Table 3: Tasks and estimated time associated with each task, needed to carry out the data collection regarding the Chilean Law of food labeling and advertising

Phase: data (photo) collection		
Task	Responsible	Estimated time
Design of data collection agendas for fieldworkers according to priorities	Fieldwork coordinator	15 min for each day of fieldwork
Data (photo) collection in supermarket, or other food store, settings	Fieldworkers	Every Tuesday, Wednesday and Thursday for as long is agreed upon with establishments
Daily meeting and discussion about data collection	Fieldwork coordinator and fieldworkers	1 hr after each day of data collection
Daily back-up (and removal of photos) from memory	Fieldworkers	.5 hr after each day of data

cards to external hard drive(s)		collection
Daily review of all photos collected	Fieldwork coordinator with possible experienced research assistants	~3 hrs after each day of data collection
Re-collection of data (photos) that were identified as having errors or being missing in which it was not possible to re-collect this data during the following day	Fieldworkers	~1 hr per mo of data collection (if possible)

Table 4: Tasks and estimated time associated with each task, needed to carry out the data management regarding the Chilean Law of food labeling and advertising

Phase: data management		
Task	Responsible	Estimated time
Data entry (for data management) design: Basic information registry platform in REDCap, supported by feedback by colleagues	Data manager and colleagues	4 hrs
Training: Basic information registry platform to project research assistant	Data manager and project research assistant	1 hr
Training: Basic information registry platform to data entry personnel	Project research assistant; data entry personnel	In-person: 3 hrs At home: 3 hrs
Fill in a basic information registry about each unique product (not photo) collected during the data collection phase that includes: <i>Year, Subcategory*, Photo date, Store ID, Multipack (yes/no), Net content, Brand, Product name*, SKU, Product maker, Number of photo associated with the product, Missing photos (yes/no) and Blurry photos (yes/no)</i>	Data entry staff	576 hrs (~6000 unique products)
Clean-up, data management, of basic product information registry	Data manager and project research	40 hrs (~6000 unique

	assistant	products)
Use of basic product information registry to create unique IDs for each unique product in which photos were collected	Data manager	80 hrs (~6000 unique products)
Re-naming ^T and organizing photo files	Data manager and project data entry persons	840 hrs (~6000 unique products)

*Subcategory refers to pre-defined subcategories; and product name refers to a particular naming standard that assumes training of data entry personnel

^T refers to the fact that all photo files can be renamed and organized at once (all prior to data entry) or concurrent with data entry

Supplemental data

File name: Supplemental Table 1 (Categories 2015_ENG.pdf)

File format: .pdf

Title of data: Supplemental Table 1: Food categories and subcategories

Description of data: List of the food categories and subcategories and associated numerical codes used to organize and manage data.

Supplemental Table 1: Food categories and subcategories		First subcategory number	First subcategory name	Second subcategory name	Second subcategory number	Numerical code
Food group number	Food group name					
1	Beverages	1	Fruit and vegetable juices	Juice concentrates	1	010101
2	Bread and bakery products			Frozen and non-frozen pulp	2	010102
3	Breakfast cereals			Fresh juices (normal, diet, light)	3	010103
4	Sweets			Canned juices	4	010104
5	Ready-to-eat foods			100% fruit juice (nothing more)	5	010105
6	Meats	2	Juice drinks (" <i>néctar</i> ")	Concentrated juice drinks	1	010201
7	Fish and seafood			Juice drinks (normal, diet, light)	2	010202
8	Dairy products	3	Flavored beverages	Powdered juice drink, normal, light or diet	1	010301
9	Canned/preserved fruits and vegetables			Liquid juice drink (e.g. <i>kapo</i>)	2	010302
10	Salsas and spreads			Liquid tea	3	010303
11	Snack foods	4	Flavored waters	With sugar	1	010401
				Without sugar	2	010402
		5	Sports drinks	Isotonic beverages (liquid and powder)	1	010501
		6	Sorbet	Popsicles	1	010601
				Carton	2	010602
		7	Sodas	With sugar	1	010701
				Without sugar	2	010702
				Other	3	010703
		8	Powdered flavored beverages	With sugar	1	010801
				Without sugar	2	010802
		9	Beverages-other	Other	1	010901
		1	Bread (only packaged)	Packaged loaf of white bread normal	1	020101
				Packaged loaf of white bread light or diet	2	020102
				Packaged loaf of white bread with grains	3	020103
				Packaged loaf of whole grain bread normal, light or diet.	4	020104
				Packaged hot dog buns	5	020105
				Packaged hamburger buns	6	020106
				Frozen white bread or dough	7	020107
				Easter bread (" <i>pan de pascua</i> ")	8	020108
		2	Dough and tortillas	" <i>Sopaipillas</i> " (frozen)	1	020201
		3	Cookies/crackers	Cookies (with sugar)	1	020301
				Cookies with filling	2	020302
				Salty crackers	3	020303
				Whole grain crackers	4	020304
				Single large packaged cookies	5	020305
				Soda crackers	6	020306
		4	Cakes, muffins and pastries	<i>Afajores</i>	1	020401
				<i>Cuchufilies</i>	2	020402
				Biscuits	3	020403
				Cake	4	020404
				Brownie	5	020405
				Filled wafers	6	020406
				Wafers without filling	7	020407
				Muffins	8	020408
				Chilean pastries	9	020409
		5	Breads and baked goods-other	Other	1	020501
		1	Granola bars	Granola bars with fruit	1	030101
				Granola bars with chocolate	2	030102

Supplemental Table 1: Food categories and subcategories

First subcategory number	First subcategory name	Second subcategory name	Second subcategory number	Numerical code
2	Breakfast cereals	Granola bars with nuts	3	030103
		Flakes	1	030201
		Stars	2	030202
		Balls	3	030203
		Puffed cereals	4	030204
		Baby cereals	5	030205
		Muesli	6	030206
		Granola	7	030207
		Oatmeal	8	030208
		Fiber	9	030209
3	Breakfast cereals and bars-other	Other	1	030301
1	Chocolates and caramels	Hard caramels	1	040101
		Soft toffees	2	040102
		Chocolates	3	040103
		Bonbons	4	040104
		Chewy candies	5	040105
		Hard lollipops	6	040106
		Nuts covered in chocolate	7	040107
		Gummy candies	1	040201
		Marshmallow candies	2	040202
		2	Gelatin-based candies	Gummy candies
Marshmallow candies	2			040202
Gum	1			040301
3	Chewing gum	Gum with filling	2	040302
		Hard candies filled with gum	3	040303
		Sweets with " <i>manjar</i> " (Chilean caramel)		
4	Sweets with " <i>manjar</i> " (Chilean caramel)	Bars of manjar	1	040401
		Balls of manjar	2	040402
		Lollipop of manjar	3	040403
		Other	1	040501
5	Sweets-other	Powdered soups (require preparation)	1	050101
		Soups for one or other types of instant soups (e.g. 'Cup of soup')	2	050102
1	Soups	Powdered cream soups	3	050103
		Vegetable bouillon	4	050104
		Instant mashed potatoes	1	050201
		Instant pastas	2	050202
		Instant rice	3	050203
2	Instant foods	Canned/preserved legumes	4	050204
		Canned/preserved vegetables	5	050205
		Pure baby food	1	050301
3	Ready-to-eat baby foods	Chopped/minced baby food	2	050302
		Pizzas	1	050401
4	Frozen foods	Potatoes	2	050402
		Spring rolls	3	050403
		<i>Empanadas</i>	4	050404
		<i>Humitas</i>	5	050405
		Other frozen foods	6	050406
		Other	1	050501
5	Ready-to-eat baby foods-other	Marinated or seasoned frozen meat products (chicken, pork, beef, turkey)	1	060101
		Breaded frozen meat products (chicken, pork, beef, turkey)	2	060102
1	Processed meats			

Supplemental Table 1: Food categories and subcategories

First subcategory number	First subcategory name	Second subcategory name	Second subcategory number	Numerical code		
2	Processed fish or seafood	Nugget (chicken or turkey)	3	060103		
		Hamburgers (chicken, pork, beef, turkey)	4	060104		
		Sausages/hot-dogs	5	060105		
		Marinated frozen fish	1	070201		
		Breaded/battered frozen fish	2	070202		
		Fish nuggets	3	070203		
		Hamburgers made of fish	4	070204		
		Breaded fish steaks	5	070205		
		Canned seafood	6	070206		
		Other	1	070401		
		1	Cheeses	Normal fresh cheeses	1	080101
				Light fresh cheeses	2	080102
				Semi-hard cheeses	3	080103
				Cream cheeses and spreads	4	080104
Shredded cheeses	5			080105		
Soft ("buttery") cheeses	6			080106		
2	Yogurt	Normal yogurt	1	080201		
		Yogurt light or diet	2	080202		
		Normal yogurt with fruit and/or nuts	3	080203		
		Yogurt with fruit and/or nuts light or diet	4	080204		
		Yogurt with sauce added	5	080205		
		Yogurt with breakfast cereals added	6	080206		
		Liquid yogurt	7	080207		
		Dairy drinks	1	080301		
		4	Milks	Liquid whole milk	1	080401
				Liquid two percent milk	2	080402
Liquid skim milk	3			080403		
Flavored whole milk	4			080404		
Flavored two percent milk	5			080405		
Flavored skim milk	6			080406		
Condensed milk	7			080407		
Evaporated milk	8			080408		
Powdered whole milk	9			080409		
Powdered two percent milk	10			080410		
Powdered skim milk	11			080411		
Milk or formula for infants	12			080412		
Milk or formula for children (1-5 years)	13			080413		
Flavored powdered to be mixed with milk	14			080414		
5	Creams	Whole milk cream	1	080501		
		Cream light	2	080502		
		Thick cream	3	080503		
		Thick cream light	4	080504		
		Fresh cream	5	080505		
		Fresh cream for whipping	6	080506		
		Whipped cream	7	080507		
		Pastry cream	8	080508		
		6	Desserts	Flan	1	080601
				Semolina	2	080602
Caramelized milk	3			080603		
Rice pudding	4			080604		
Cold desserts (e.g. ready-to-eat puddings)	5			080605		

Supplemental Table 1: Food categories and subcategories

First subcategory number	First subcategory name	Second subcategory name	Second subcategory number	Numerical code
		Frozen cakes/tarts	6	080606
		Frozen biscuits (e.g. ice-cream sandwiches)	7	080607
		Frozen desserts	8	080608
7	Ice creams	Milk-based ice cream	1	080701
		Milk-based ice cream light	2	080702
		Milk-based ice cream diet	3	080703
		Ice cream bars	4	080704
		Frozen yogurt	5	080705
8	Dairy products-other	Other	1	080801
1	Fruit compotes and marmalades	Marmalades (normal, light, sugar-free)	1	090101
		Dulce	2	090102
		Fruit compotes	3	090103
		Jell-O	4	090104
2	Preserved fruit	Preserved fruit with sugar	1	090201
		Preserved fruit without sugar	2	090202
3	Dried fruits	Fruit/vegetable chips	1	090301
4	Canned/preserved fruits and vegetables-other	Other	1	090401
1	Sauces	Tomato sauce	1	100101
		Mayonnaise	2	100102
		Ketchup	3	100103
2	Spreads	<i>Manjar</i>	1	100201
		<i>Manjar</i> light	2	100202
		Cocoa cream spreads (e.g. <i>Nutella</i>)	3	100203
		Butter	4	100204
		Margarine	5	100205
		Light Margarine	6	100206
		Cow milk-based caramel (<i>dulce de leche</i>)	7	100207
		Honey	8	100208
		Palm syrup	9	100209
		Icing	10	100210
		Peanut butter	11	100211
3	Sauces and spreads-other	Other	1	100301
1	Potato chips		1	110101
2	Potato shoestrings		1	110201
3	Nuts		1	110301
4	Sweet or salty puffed snacks		1	110401
5	Baked corn snacks		1	110501
6	Popcorn		1	110601
7	Tortilla / corn-based chips		1	110701
8	Snack foods-other		1	110801