Nutrición Hospitalaria

Assessment of Beverage intake and Hydration status

Mariela Nissensohn[1,2], Marisa López-Ufano[3], Itandehui Castro-Quezada[1] and Lluis Serra-Majem[1,2]

[1]Nutrition Research Group, Research Institute of Biomedical and Health Sciences (IUIBS), University of Las Palmas de Gran Canaria. [2]Ciber Obn Physiopathology of Obesity and Nutrition. Institute of Health "Carlos III", Madrid. [3]Madrid European University (UEM) and Servicio Madrileño de Salud (SERMAS). Spain.

Abstract

Water is the main constituent of the human body. It is involved in practically all its functions. It is particularly important for thermoregulation and in the physical and cognitive performance. Water balance reflects water intake and loss. Intake of water is done mainly through consumption of drinking water and beverages (70 to 80%) plus water containing foods (20 to 30%). Water loss is mainly due to excretion of water in urine, faeces and sweat.

The interest in the type and quantity of beverage consumption is not new, and numerous approaches have been used to assess beverage intake, but the validity of these approaches has not been well established. There is no standardized questionnaire developed as a research tool for the evaluation of water intake in the general population. Sometimes, the information comes from different sources or from different methodological characteristics which raises problems of the comparability. In the European Union, current epidemiological studies that focus exclusively on beverage intake are scarce.

Biomarkers of intake are able to objectively assess dietary intake/status without the bias of self-reported dietary intake errors and also overcome the problem of intra-individual diet variability. Furthermore, some methods of measuring dietary intake used biomarkers to validate the data it collects. Biological markers may offer advantages and be able to improve the estimates of dietary intake assessment, which impact into the statistical power of the study. There is a surprising paucity of studies that systematically examine the correlation of beverages intake and hydration biomarker in different populations.

A pilot investigation was developed to evaluate the comparative validity and reliability of newly developed interactive multimedia (IMM) versions compared to validated paper-administered (PP) versions of the Hedrick et al. beverage questionnaire. The study showed that the IMM appears to be a valid and reliable measure to assess habitual beverage intake. Similar study was developed in China, but in this case, the use of Smartphone technology was employed for beverage assessment.

Conclusion: The methodology for measuring beverage intake in population studies remains controversial. There are few validated and reproducible studies, so there is

VALORACIÓN DE LA INGESTA DE BEBIDAS Y EL ESTADO DE HIDRATACIÓN

Resumen

El agua es el principal constituyente del cuerpo humano. Está implicado en prácticamente la totalidad de sus funciones. Es especialmente importante en la termorregulación y en el rendimiento físico y cognitivo. El balance de agua refleja la ingesta y la pérdida de agua. La ingesta se realiza principalmente a través del consumo de agua potable y de bebidas (70 a 80%) más el agua que contienen los alimentos (20 a 30%). La pérdida de agua se realiza gracias a su excreción a través de la orina, las heces y el sudor.

El interés por el tipo y la cantidad de bebidas consumidas no es nuevo, y numerosos enfoques se han utilizado para evaluarla, pero la validez de estos enfoques no se han establecido correctamente. Aún no existe, en población general, un cuestionario estandarizado desarrollado como herramienta de investigación para la evaluación de la ingesta de agua. El uso de información de diferentes fuentes y diferentes características metodológicas plantea problemas de comparabilidad entre estudios. En Europa los estudios epidemiológicos actuales que se centran exclusivamente en el consumo de bebidas son escasos.

Los biomarcadores de ingesta permiten evaluar objetivamente la ingesta dietética sin el sesgo producido por los errores del auto-reporte. Además permiten superar el problema de la variabilidad intra-individual. Algunos métodos para medir ingesta alimentaria utilizan biomarcadores para validar los datos que recoge. Los marcadores biológicos ofrecen ventajas y son capaces de mejorar las estimaciones de la evaluación de ingesta dietética. Sin embargo, existen muy pocos estudios que examinen sistemáticamente la correlación entre la ingesta de bebidas y los biomarcadores de hidratación en diferentes poblaciones.

Utilizando el cuestionario de bebidas de Hedrick y col. se realizó un estudio piloto para evaluar la validez y fiabilidad de un modelo multimedia interactivo (IMM) y para compararlo con una versión en papel-auto administrado (PP). El estudio mostró que el IMM parece ser un modelo válido y fiable para evaluar la ingesta de bebidas habitual. Un estudio similar se realizó en China, pero en este caso, se empleó para evaluar ingesta de bebidas la tecnología Smartphone.

Conclusión: La metodología para valorar el consumo de bebidas en estudios poblacionales sigue siendo un tema controvertido. Existen pocos estudios validados y reproducibles, por lo que todavía no se dispone de un mé-

Correspondence: Nissensohn Mariela,
Department of Clinical Sciences,
University of Las Palmas de Gran Canaria,
Las Palmas de Gran Canaria, Spain.
E-mail: mnissensohn@acciones.ulpgc.es

still lacking an ideal method (ie, short, easy to administer, inexpensive and accurate) in this regard. Clearly, this is an area of scientific interest that is still in development and seems to be very promising for improving health research.

todo ideal (corto, fácil de administrar, económico y preciso). Esta es un área de interés científico que aún está en desarrollo y que parece ser muy prometedora para mejorar las investigaciones en el área de la salud.

Introduction

Water is the main constituent of the human body. About 63% of body weight in adult males and 50 to 55% in females, because they have a higher proportion of body fat than males, and up to 75% in a newborn infant[1]. Two-thirds of total body fluid is intracellular, and the remaining third is extracellular fluid, which is divided into plasma and interstitial fluid. There is also a third space, known as "transcellular fluid", which is contained in body cavities, such as cerebral spinal fluid and synovial, peritoneal and pleural fluids. Although these fluid compartments are classified as separate areas, water and electrolytes continuously circulate between them.

Water is involved in practically all functions of the human body. It is particularly important for thermoregulation and in the physical and cognitive performance. Drinking at least five glasses of water or more per day was associated with lower rates of death from coronary heart disease in middle-aged and elderly subjects. Good hydration can reduce the risk of developing kidney stones because the urine diluted helps preventing stone formation. Furthermore, water is considered as an essential part of the dietary management of diabetes because limit the development of diabetic ketoacidosis during insulin deficiency in type 1 diabetes, helping to maintain healthy blood sugar levels. Adequate fluid intake has been associated with gastrointestinal benefits: lower rate of constipation and lower use of laxatives fees. Some authors have reported a reduced risk of bladder cancer in men, urinary tract infections, dental disease, and benefits in bronchopulmonary disorders.

Fluid balance is a term used to describe the balance of the input and output of fluids in the body to allow metabolic processes to function correctly[2]. Water balance reflects water intake and loss. Water intake is done mainly through consumption of drinking water and beverages (70 to 80%) plus water containing foods (20 to 30%). Food water content is usually below 40% in bakery products, between 40% and 70% in hot meals, 48% in fruit and vegetables and about 90% in both human and cows' milk[1]. Diets rich in vegetables and fruit provide significant amounts of the total water intake, whereas, for example, fast food products as a rule have low liquid content[3]. Water loss is mainly due to excretion of water in urine, faeces and sweat. The contribution of sweat in water loss is higher in physically active person and in hot climates. Therefore, this component is highly variable depending on the lifestyle of the individual and on the environmental conditions[4].

Assessment beverages intake

At the present time, beverages seem to influence the diet and nutrient intakes more than in previous generations, likely due to increased accessibility, changing food trends, and marketing by food venders. The importance of beverages as foods and their effects on nutrient intake have recently been the focus of intense scrutiny. However, the interest in the type and quantity of beverage consumption is not new, and numerous approaches have been used to assess beverage intake, but the validity of these approaches has not been well established[5].

Until now, in the dietary surveys, beverage consumption was recorded as part of the food frequency questionnaires (FFQ) or 24 h recalls. However, these tools were designed especially for recording food intake, no beverages. Moreover, often, in many studies, assessment of water consumption is dismissed or rarely mentioned, since it does not contribute calories or nutrient. Furthermore, beverage intake has focused on sugary drinks (in most of the children and adolescents surveys) and alcoholic beverages (in most of adults' surveys). Sometimes the information comes from different sources or from different methodological characteristics, which raises problems of the comparability. In general, the studies focused the moment of consumption, i.e. meals and snacks, but many people consume water between meals without necessarily consuming other calories, and this amount does not generally show up on records. This result in a low estimate of the amount of water consumed. The timing of the studies is needed and also the seasonally because the weather variations along the year could affect the volume of beverage and water consumption.

There is no standardized questionnaire developed as a research tool for the evaluation of water intake in general population. Sometimes, the use of information from different sources and different methodological characteristics raises issues of comparability that are difficult to address. Furthermore, dietary intake of

water is a highly variable event, which experiences significant differences by the day of the week, by the body size, by the physical activity and by the climatic exposure[6] on a basic underlying pattern of consumption.

In the European Union, current epidemiological studies that focus exclusively on beverage intake are scarce. This hinders research on this topic, which is needed to underpin nutrition policies for these populations. On 2013 we developed a study[7] who described which was the most frequent method applied to assess water (or liquid) intake in European populations. This study reported a current comprehensive overview of European hydration data using gray literature as source of information. Twelve epidemiological studies conducted between years 2003 and 2011 were included. We assigned three major groups of liquid intake in order to organize the beverage intake information extracted. The groups were: 1) total water, 2) non-alcoholic beverages and 3) alcoholic beverages. In some cases, information of total water was collected as mineral water or tap water. Non-alcoholic beverages data were divided into four subgroups (fruit and vegetable juices, coffee, tea and other hot drinks, milk and milk drinks, and carbonated, soft, isotonic drinks and others). With the average intake of water, soft drinks and alcohol intake, we calculated total fluid intake, reported in g/d. However, none of the studies collected information from all categories of beverages evaluated. The beverage information was collected by different types of assessment: 7-d dietary record, 3-d dietary record, 24-h recall, 4-d semi-weighted food record and a Beverage Dietary History applied only in Germany. The Beverage Dietary History was developed to assess beverage intake exclusively. We consider that this reliable beverage intake questionnaire may be desirable for practitioners as well as for researchers assessing habitual beverage intake, although some refining may be needed. The results of this review show that the studies on beverage intake in European countries are diverse with regard to design: they differ in dietary assessment; composition databases, sampling procedures and age range, and this may confound comparisons between countries. Those differences are derived from the methodology used. The choice of an appropriate method is essential in order to have a precise and reliable recollection of information. It is really necessary to focus on developing a method that provides more accuracy and reliability to record all liquids drank at different times, before, during and after meals, specifying each case the amount consumed the type of beverages and the seasonal variability.

What is the real implication of not having enough records that obtain accurate water or beverage consumption? If we note that the recommendations of water consumption or ''adequate intake'' are based on these kind of surveys, it is easy to understand that they are not always adapted well enough to populations and even less to different physiological states[7].

The European Food Safety Authority (EFSA) in addition to affirming that there is lack of data, proposed a clear need to develop a better methodology to produce intake recommendations evidence-based fluids.

Hydration biomarkers

Recently, several questionnaires have been developed to evaluate water intake or the contribution of solid and fluid foods to water intake. These are usually based on reporting the recalled frequency of intake of fluid and solid foods and of drinking water. A common limitation of research in this area is a reliance on self-reported measures of habitual intake. Thus, the need for novel methods to assess intake objectively beverage intake and hydration status, such as beverage's biomarkers, has been recognized[8]. Those biomarkers are able to objectively dietary intake/ status without the bias of self-reported dietary intake errors[8], and also overcome the problem of intra-individual diet variability. Furthermore, some methods of measuring dietary intake use biomarkers to validate the collected data. Biological markers may offer advantages and be able to improve the estimates of dietary intake assessment, due to the independence of their random errors in relation to the errors inherent to the intake questionnaires (memory of the interviewee, underestimate beverage intake reported), which impact into the statistical power of the study. When a method of dietary intake uses one or more biomarkers to validate the data it collects, the validation study is also called relative validation/calibration study. In this case, one dietary method is compared to another beverage intake assess method. The correlation coefficients obtained from the validation studies can reflect the capability of the method to rank individuals according to beverage intake.

However, biomarkers do not replace the traditional methods of food intake. They should be used as additional measures. Moreover, most of the biomarker analyses are expensive, with some degree of invasiveness and quite often it is not possible to perform them as part of a large epidemiological study[9].

Various markers have been proposed to assess the state of hydration (plasma osmolality, urine specific gravity (Usg), urine osmolality, total volume of urine for 24 hours, etc) (Table I), which can be used in different laboratory conditions, clinical practice or sports. However, to current date, there is a lack of an universally accepted biomarker that reflects[10] the increase of hydration status in response to an increase in beverage intake. Therefore, there are no markers defined as "gold standard"[11].

Furthermore, there is a surprising paucity of studies that systematically examine the correlation of beverages intake and hydration biomarkers in different populations. Only two recently questionnaires have been designed to capture the usual beverage intake and were validated against Usg as a biomarker:

1. Beverage Intake Questionnaire (BEVQ) from Hedrick et al.[12] developed in the United States. The BEVQ was created to estimate mean daily intake of water, sugar sweet beverages and total beverages across 19 beverage categories plus one open-ended section for "other" beverages not listed. This tool is a quantitative food frequency questionnaire; it allows assessing the frequency of food items and amounts consumed. It was developed to be useful for researchers and clinicians interested in assessing habitual beverage consumption patterns, particularly in large-scale investigations where lengthier, resource-intensive dietary intake assessment techniques are not feasible. Among dietetic practitioners, this tool could be utilized as rapid method to assess beverage consumption as part of nutrition assessment in the primary care process, surveillance and evaluation. In the BEVQ, beverage categories were grouped by energy and macronutrient content using published food composition tables[13] and nutritional analysis software. Common United States beverage portion sizes (e.g., 12 fl oz can of soft drinks, 20 fl oz bottles of juice/water/soft drinks), and common United States cup sizes (e.g., juice glasses [4–6 fl oz] and cups [8 fl oz]) were utilized to correctly assess the amounts consumed. Due to the desire to develop a brief, single-page

Table I
Characteristics of Hydration Biomarkers

Hydration Assessment Technique	Body Fluids Involved
Stable isotope dilution	all (ECF and ICF)
Neutron activation analysis	all
Bioelectrical impedance spectroscopy (BIS)	uncertain
Body mass change (a)	all
Plasma osmolality (b)	ECF
% plasma volume change	blood
Urine osmolality	excreted urine
Urine specific gravity	excreted urine
Urine conductivity	excreted urine
Urine colour	excreted urine
24-hour urine volume	excreted urine
Salivary flow rate, osmolality, total protein	whole, mixed saliva
Rating of thirst	hypothalamus

Abbreviations:
ECF: extracellular fluid; ICF: intracellular fluid.
(a) using a floor scale.
(b) freezing point depression method.
From Armstrong LE. Assessing hydration status: the elusive gold standard. *J Am Coll Nutr* 2007; 26 (5 Supl): 575S-584S.

BEVQ, the most commonly consumed beverage units were included. To score the BEVQ, frequency ("How often") was converted to the unit of times per day, then multiplied by the amount consumed ("How much each time") to provide average daily beverage consumption in fl oz. Energy and grams (per fl oz) for each beverage category were determined using food composition tables[13]. Total energy and grams of each beverage were determined by multiplying the number of fl oz per day by the energy and grams per fl oz of each category.

2. Water balance questionnaire (WBQ) from Malisova et al.[4] in Greece. The WBQ included a series of questions regarding a) the profile of the individual; b) consumption of solid and fluid food (FFQ which included 58 food items); c) drinking water or beverage intake; d) physical activity; e) sweating; f) urine and faecal excretions and g) trends on fluid and water intake, and it was filled in a 3-day diary. A series of questions regarding age, gender, years of education, profession and health status, emphasizing medication and disease that may affect hydration such as kidney disease, urinary tract infection or diabetes, were included to assess the profile of the interviewee. The assessment included information about the lifestyle of the individual, eating and drinking habits, activity levels, as well as weather conditions, may affect water balance. The reference portion of the FFQ was settled next to the food or the liquid, and the frequency of consumption was recorded as 'never', 'once a month', '1–3 times per month', '1–2 times per week', '3–6 times per week', 'once per day' to 'more than twice a day'. Habits on drinking water or beverages were recorded in detail seeking quantitative information on glasses, bottles or cups consumed per day. The level of physical activity was estimated through the International Physical Activity Questionnaire[14] while duration of physical activity was recorded for three activity levels (intense, moderate and mild) or for sedentary conditions. This questionnaire allows an evaluation of water balance from the estimation of water intake and loss through properly designed questions. Water intake refers to water from solid and fluid foods and drinking water[1]; thus, it depends on the eating and drinking habits of the individual. Water loss refers mainly to water excreted in urine, faeces and sweat. For the evaluation of water loss, self-estimation with the aid of a point scale scoring was used. This innovative approach was based on the recent concept that point scales are important tools in evaluating an individual's health characteristics when those are difficult to or cannot be measured directly[15]. They are also considered as reliable tools and therefore during the past years, they have become a routine part of evaluating interventions and health care planning. The application of a point

scale in the estimation of water loss in urine, faeces and sweat involved the difficulty of quantifying self-reporting increments, i.e. to correspond the scoring of the point scale to water volume. This was achieved by accepting that the range of scores provided in the point scale corresponded to the range of physiological water losses in urine, faeces or sweat. Sweating was recorded using a 10-point scale twice, for activity or sedentary conditions. Urination and defecation were recorded on the basis of frequency.

At the final section of the WBQ, attitudes and trends about consumption of fluids as well as knowledge of the participant on recommended water intake for males and females were recorded[4]. The WBQ was shown to be a practical research tool for estimating water balance because it allowed screening a relatively large sample and gather detailed information on water balance. Nevertheless, interpretations on screening for water loss must be treated with particular caution because the WBQ has been validated for water balance and for water intake but not for water loss[4]. It must be noted that, with this research tool, it was not possible to draw conclusions on the hydration status of the population. This limitation arises because the threshold limits on water balance from the WBQ for euhydration, hyperhydration and dehydration have not been established. Consequently, if such threshold limits are recognised, then the WBQ would be a sufficiently powerful questionnaire that could provide useful information in relation to the hydration of the population[16].

In Hedrick´s study[12], the correlation measured by BEVQ against Usg as a biomarker was negatively correlated in two measures: the first one (r=-0.202, $p < 0.05$ was found, when people drank $2,017 \pm 94$ ml and r = -0.238, $p < 0.05$ in the second measure when people drank $1,965 \pm 96$ ml).

Malisova´s study[4] reported no statistically significant correlations between beverage intake estimated from the WBQ against Usg ranging of -0.107, $p = 0.403$. However, they found moderated correlations with the others biomarkers measured (Urine volume, Urine Color, Urine Osmolality). Moreover, results reveled high validity of the WBQ among females (n = 25; correlation with urine osmolality $r = 0.43$, $p = 0.004$; with urine volume $r = 0.3$, $p = 0.04$ and with urine colour $r = -0.35$, $p = 0.033$) but not among males (n = 15; all $ps > 0.05$).

The FFQ used in the BEVQ of the Hedrick's study[12] appears to be a better measuring method for assessing beverage intake than the 3-day dietary questionnaire used in Malisova's study[4] when compared to biomarkers. However, this conclusion is based just in the global correlations found from FFQ and Usg of two papers. There not gold method or gold biomarker. Thus, at present time the WBQ of the Malisova's study[4] seems to a more complete method to evaluate the hydration balance.

Situation in Spain

Over recent months, we have adapted the questionnaire proposed by Hedrick et al.[12], to Spanish population and it is being tested in a group of 120 people participating in the study PREDIMED PLUS (www.predimedplus.com), men and women aged 56 or more, from the cities of Reus and Las Palmas (Annex I). The objective of this questionnaire is to evaluate the consumption of water and drinks in the Spanish population and to validate it against biomarkers of hydration, to obtain reliable data on beverage consumption, in order to determine the consumption patterns of different populations. To achieve this, we will analyze urine osmolality, Usg and total volume of urine for 24 hours. The data obtained through the questionnaire will be correlated with biochemical data analysis using Pearson or Spearman correlations, and then patterns of consumption will be established.

New tools development

Due in part to the increased use and accessibility of computers in multiple settings[17] (i.e. homes, libraries, churches, recreational community centers, grocery stores, and schools)[18], the use of Web and computer-based assessment in large research trials has increased over the past 10 years[19,20]. The National Institute of Health has recognized the need for novel/innovative assessment methods using technological advances in physical activity and dietary assessment. Recently, computerized diet and physical activity assessments have emerged. But, until now, there is no consensus to whether a paper-based assessment is superior to a computerized one[21]; however, computer-based tools can provide an alternative means to collect and analyze data and may be appealing to practitioners and researchers because of their proposed benefits. Computer-administered assessments may overcome difficulties sometimes associated with paper-based surveys as they allow for interactivity-two-way communication between computer and participant through photographs, videos, and displayed text with or without audio[18]. Other advantages of computerized questionnaire administration include-complete responses (ie, prompting individuals to answer all questions), written and narrated text, visual cues of portion sizes, immediate and rapid data entry and scoring, decreased scoring errors, increased attentiveness from participants, instantaneous feedback, and a greater ability to access understudied populations[20]. Additionally, multi-part questions of computerized assessments can be programmed to reduce administration time by providing only relevant data and information for the participant[18]. In low health literacy populations, computerized questionnaires may be advantageous since text can be narrated and visual aids can be used, which may reduce response errors and the necessity of advanced reading skills[18]. Another potential advantage of computer-ba-

Annex I

ESTUDIO PREDIMED PLUS
CUESTIONARIO
DE INGESTA DE BEBIDAS

Nodo	Paciente	Visita	Fecha Actual
☐☐	☐☐☐☐☐	☐☐	☐☐☐

Instrucciones:

Por favor indique su respuesta haciendo referencia al mes pasado.

Por cada tipo de bebida consumida, marque con un número la cantidad de veces al día o a la semana, y con una "X" el momento en que la bebió.

Por ejemplo, si usted bebió 2 vasos de vino por semana, marque en "veces", en la columna"a la semana" el número 2. Si se trata de una bebida que consume todos los días, por ejemplo agua, indique cuantas veces "al día", por ejemplo: 6 veces al día.

2. No cuente los líquidos utilizados en la cocina o en otras preparaciones, como por ejemplo al preparar una salsa o un postre casero.

3. Si consume el café con leche, márquelo en la categoría de bebidas "café con leche" y no en las categorías de leche.

4. Si realiza actividad física, recuerde incluir los líquidos ingeridos durante la práctica.

		FRECUENCIA DE CONSUMO											
		VECES			MOMENTO								
TIPO DE BEBIDA		NUNCA O CASI NUNCA	A LA SEMANA	AL DÍA	ANTES DEL DESAYUNO	CON EL DESAYUNO	ENTRE DES. Y COMIDA	CON LA COMIDA	ENTRE COMIDA Y CENA	CON LA CENA	DESPUÉS DE LA CENA	DURANTE LA NOCHE
Agua de grifo	1 botellín o 1 vaso: 200 cc												
Agua embotellada (con gas/ sin gas)	1 botellín o 1 vaso: 200 cc												
Zumos naturales de frutas	1 vaso: 200 cc												
Zumos envasados de frutas	1 vaso: 200 cc												
Zumos vegetales naturales (gazpacho, de tomate,…)	1 vaso: 200 cc												
Zumos vegetales envasados (gazpacho, de tomate,…)	1 vaso: 200 cc												
Leche entera	1 vaso o taza: 200 cc												
Leche semidesnatada	1 vaso o taza: 200cc												
Leche desnatada	1 vaso o taza: 200 cc												
Lácteos bebibles	1 botellín: 100 cc												
	1 botellín o 1 vaso: 200 cc												
Batidos lácteos	1 vaso: 200 cc												
Bebidas vegetales (bebida de soja, almendras, almendrina…)	1 vaso: 200 cc												
Sopas y caldos	1 taza o plato: 200 cc												
Sorbetes, gelatinas	1 unidad: 120 cc												
Refrescos	1 botellín o 1 vaso: 200 cc												
	1 lata: 330 cc												
Refrescos Light /Zero	1 lata: 330 cc												
	1 botellín o 1 vaso: 200 cc												
Café sólo o cortado con azúcar	1 taza: 30-50 cc												
Café sólo o cortado sin azúcar, con/sin edulcorante artificial	1 taza: 30-50 cc												
Café con leche o americano y azúcar	1 taza: 125 cc												
Café con leche o americano sin azúcar, con/sin edulcorante artificial	1 taza: 125 cc												
Té con azúcar	1 taza: 200 cc												
Té sin azúcar, con/sin edulcorante artificial	1 taza: 200 cc												
Otras infusiones con azúcar	1 taza: 200 cc												
Otras infusiones sin azúcar	1 taza: 200 cc												
Cerveza, Sidra	1 botellín o 1 vaso: 200 cc												
	1 lata: 330 cc												
Cerveza sin alcohol o Light	1 lata: 330 cc												
	1 botellín o 1 vaso: 200 cc												
Vino (tinto, rosado o blanco), cava	1 vaso: 120 cc												
Bebidas alcohólicas de alta graduación (whisky, ron, vodka, ginebra)	1 copa 50 cc												
Bebidas alcohólicas combinadas (cubata, gintonic, piña colada, daikiri, otras)	1 vaso: 200 cc												
Bebidas energéticas (Red Bull, Burn,…)	1 vaso: 200 cc												
Bebidas para deportistas/isotónicas	1 vaso: 200 cc												
	1 lata: 330 cc												
Batidos sustitutivos de comidas/ híper proteicos	1 vaso: 200 cc												
Otros (especifique):													

sed assessments is that response-bias and intimidation may be reduced with computer-administered surveys, although additional research addressing this possibility is needed[18,22,23]. However, when using identical computerized versions of paper assessments comparability cannot be assumed because interface characteristics like font size, line length, scrolling ability, and amount of information visible on the screen can all influence user performance[24].

Prior research has demonstrated the reliability and validity of the self-administered paper-based questionnaire that assesses habitual beverage intake (BEVQ-15)[25]. To the best of our knowledge, no computer-based beverage intake questionnaire exists. The recently developed Automated Self-Administered 24-hour Recall[26] is computer-based and contains questions about beverage intake; however, results on its validity and usability has yet to be published[27]. Lately a pilot investigation was developed to evaluate the comparative validity and reliability of newly developed interactive multimedia (IMM) versions compared to validated paper-administered (PP) versions of the BEVQ-15[25]. The conclusion of the study shows that the IMM BEVQ-15 appears to be a valid and reliable measure to assess habitual beverage intake, although software familiarization may increase response accuracy. Future larger-scale investigations are warranted to confirm these possibilities.

Similar study was developed by Smith et al.[28] in China, but in this case, the use of Smartphone technology was employed for beverage assessment. Smartphone offered a promising new way to record beverage consumption, as participants can easily capture images of beverages prior drinking[29]. In particular, video records provide an enhanced ability to see all food items in a shot, and also can encompass voice annotation, allowing the participants to describe the foods or beverages consumed. These videos and vocal records can then be used during 24-hour recalls to prompt memory and aid portion size estimation, improving the accuracy of the 24-hour recall[30]. In addition, the study employed the Ecologic Momentary Assessment (EMA), a periodically assessment that prompts participants to record beverages they have recently consumed[31], further reducing the likelihood of omission.

The objectives of this study were: 1) to compare beverage consumption data collected using a 3-day Smartphone-assisted 24-hour recall (SA-24R) vs. beverage data collected using the written record-assisted 24-hour recall (WA-24R) and 2) to validate, in a small subset, the extent to which each recall method adequately estimates total beverage intake based on correlation with total urine volume measured in 24-hour urine samples.

For this study, also the BEVQ of Hedrick study[25] was used. The beverage categories were adapted from a validated beverage questionnaire screener in consultation with a panel of experts about beverages that are commonly consumed in China. In this study, the SA-24R and WA-24R showed moderate correlation between re-

ported fluid intake and total urine output. Correlations between the two methods showed moderate agreement across beverage categories, with an average Spearman rank correlation of 0.42. Despite these moderate correlations, mean beverage intake was significantly lower by 222 g/day in the SA-24R compared to the WA-24R. In this case, the use of a SA-24R does not appear to improve the quantification of beverage intake compared to a WA-24R recall in Chinese population.

Further recearch is required to understand the optimal method for collecting information on beverage intake in the dynamic food environment.

Conclusion

The methodology for measuring beverage intake in population studies remains controversial for most of the researchers. There are few validated and reproducible studies, so there is still lacking an ideal method (i.e., that is short, easy to administer, inexpensive and accurate) in this regard. Sidossi[32] argues that the ideal methodology does not exist so far and that existing validated methods (24 hours recall and food frequency questionnaires) accompanied by a computer program on food composition are acceptable and reliable for the beverage intake assessment[32]. Clearly, this is an area of scientific interest that is still in development and seems to be very promising for improving health research.

Acknowledgements

Conflict of Interest Section

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