

# A Reliable, Valid, Sensitive and Simple Method to Quantify Carbohydrate Routine Consumption among Patients with Type 2 Diabetes

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## Abstract

**Objective:** Growing evidence suggests postprandial hyperglycemia, driven largely by carbohydrate consumption, adversely affects A1c and cardiovascular health. The standard for quantifying carbohydrate intake is 24-hour dietary recall (ASA24), which is tedious, time consuming, under-samples due to a short measurement period, and is often impractical. An alternative is needed.

**Research Design and Methods:** We developed the Carbohydrate Routine Consumption (CRC) scale, which quantifies weekly servings of 16 common high and low glycemic load foods and takes 5 minutes to complete and score. We administered the CRC and the ASA24 to 204 adults with type 2 diabetes.

**Results:** The CRC was reliable, correlated with the ASA24 and had similar construct and discriminant validity.

**Conclusion:** The CRC is psychometrically sound and easily employed by clinicians and researchers to document weekly servings of carbohydrate consumption.

**Keywords:** Type 2 diabetes mellitus; diet; knowledge; attitude; practices; complications

## Introduction

Given that carbohydrates are a major contributor to post prandial glucose (PPG) (1), which in turn is a major contributor to A1c (2), and possibly an independent contributor to diabetic cardiovascular complications (3), researchers and clinicians need to quantify routine carbohydrate consumption. This was made more salient by the 2020 American Diabetes Association Standards of Care (ADA 2020), which states: “Reducing overall carbohydrate intake for individuals with diabetes has demonstrated the most evidence for improving glycaemia and may be applied in a variety of eating patterns”). The 24-hour dietary recall (ASA24) (4) is considered the gold standard for quantifying carbohydrate intake, but it is not practical for clinicians and many researchers. For standardization, the ASA24 requires a trained examiner conducting three 30-minute scheduled telephone interviews using an online form to enter all the nutrients consumed in the past 24 hours, their volume and how the foods were prepared. The data is analyzed by the ASA24 server, and the user must make a batch request for all recalls completed in a study, the results of which are typically available a day later. Consequently, we developed a simpler, self-report questionnaire that quantifies servings of carbohydrates routinely consumed (CRC) in a typical week, that can be administered in five minutes and scored in one minute (see supplemental figure S1).

## Materials and Methods

**Instrument:** To solicit a representative sampling of routinely eaten carbohydrates, the CRC asks: “How many servings of the following foods do you eat in an average week? A serving size is about the size of a deck of cards. A large or a ‘supersized’ serving is equal to two servings”. For brevity and ease of use, the CRC does not list all food varieties and their preparations. Instead, it presents 16 classes of foods with a glycemic load > 10 (items 1-16, CRCHGL), e.g. “potatoes like mashed, baked, fried, white, red, sweet, potato soup, potato pancakes, etc.”, and 16 classes of foods with a glycemic load < 7 (items 17-32, CRCLGL), e.g. “green vegetables like peas, spinach, brussel sprouts, broccoli, etc.” (1). The CRCHGL and CRCLGL scores are the sum of the reported servings consumed in an average week for items 1-16 and 17-32, respectively. We performed pilot testing to clarify items and affirm initial reliability. This report focuses on the CRCHGL. We hypothesized that the CRCHGL would have significant: 1) test-retest reliability, 2) concurrent validity (a moderate correlation with the ASA24 carbohydrate count), 3) construct validity (a positive correlation with A1c, BMI, calorie intake, depressive symptoms [eating comfort foods]), and 4) discriminant validity (a decreased response to a PPG-lowering intervention, but not to a weight loss intervention, and a pre-post change in A1c correlation only in the PPG-lowering intervention). As a control, we hypothesized that =esi=esi=CRCHOCH

