GoCARB accuracy on carbohydrate estimation versus visual estimations by dietitians

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Background and aims

Carbohydrate (CHO) intake plays a vital role in diabetic patients' glucose control and well-being. A smartphone system, named GoCARB[1], based on the use of artificial intelligence and computer vision was recently introduced to estimate the meal's CHO content using two images of a plated meal. GoCARB has been clinically validated for individuals with type 1 diabetes.[2]

Aim of the study is to compare the accuracy of GoCARB[3] in estimating CHO with the visual estimations of six dietitians and the actual weight of the meals provided (reference method). Moreover, possible differences on CHO estimation between USDA and Swiss databases need to be investigated.
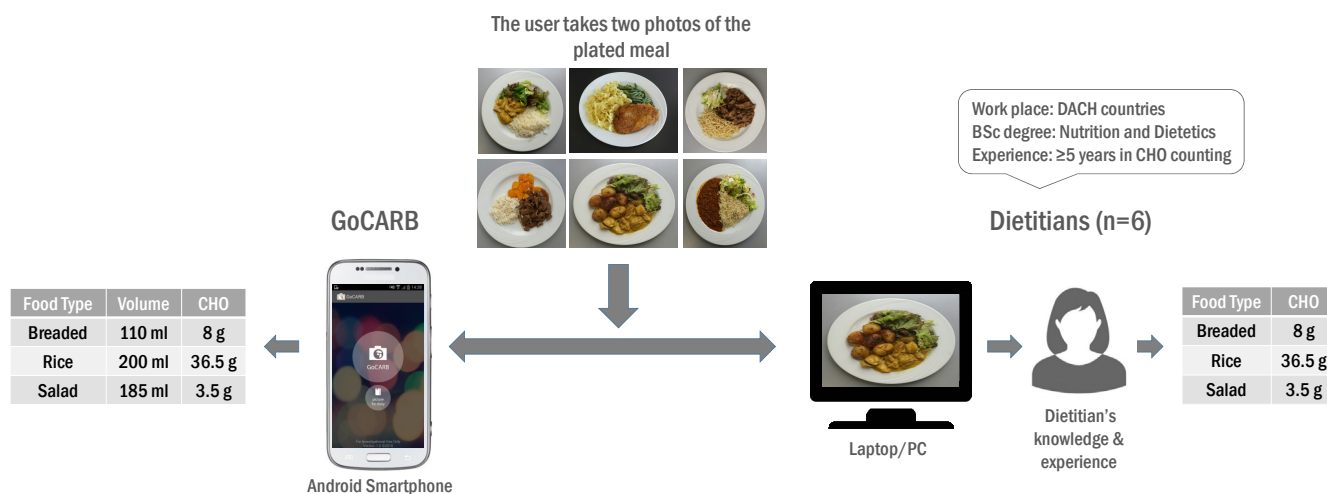
Methodology

Meals

- Multiple images from 54 typical Central European meals
- Each meal contained three different food items
- Three different sizes of each meal: small, medium , large

Ground Truth (GTR)

- Each food item was weighed using a household scale
- The CHO content was estimated using the meals' exact food items in nutrient databases (both the USDA and the Swiss food composition databases were used)

The user takes two photos of the plated meal

GoCARB

Food Type	Volume	CHO
Breaded	110 ml	8 g
Rice	200 ml	36.5 g
Salad	185 ml	3.5 g

Android Smartphone

Work place: DACH countries
BSc degree: Nutrition and Dietetics
Experience: ≥5 years in CHO counting

Dietitians (n=6)

Laptop/PC

Dietitian's knowledge & experience

Food Type	CHO
Breaded	8 g
Rice	36.5 g
Salad	3.5 g

Results

Accuracy

GoCARB and dietitians achieved comparable accuracies (Table 1), independent of the database used to calculate the GTR, while the use of the local nutrient database seems to improve the CHO estimation of GoCARB system.

Table 1. Comparison of the mean (±SD) absolute error in grams of CHO estimation of the dietitians and GoCARB

Ground truth	Dietitians	GoCARB	p-value
USDA food composition database	14.9 ± 10.1	14.8 ± 9.7	0.93
Swiss food composition database	14.2 ± 9.6	12.6 ± 8.5	0.19

Effect of meal sizes

No differences were found between the estimations of dietitians and GoCARB regarding meal size. The larger the size of the meal, the greater the estimation errors were made in both methods (Table 2).

Table 2. Mean (±SD) absolute errors of dietitians and GoCARB with respect to meal size

Meal size	Dietitians	GoCARB	p-value
Small	5.9 ± 3.5	8.5 ± 5.6	0.18
Medium	7.6 ± 6.3	11.3 ± 8.9	0.27
Large	19.4 ± 15.2	20.7 ± 11.6	0.41

n =18 for each meal size group

Conclusions

The GoCARB system may offer diabetic patients the option of an easy, accurate and almost real-time estimation of the CHO content of meals on plates and thus help to enhance and improve diabetes management.

Acknowledgements

References

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