Glycemic Response to Raisins, Grapes and Bananas in College Aged Students

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INTRODUCTION

Raisins are a nutritious snack containing fiber, antioxidants, potassium, and carbohydrates. Raisins have a relatively high fiber content (soluble and insoluble), a viscous food matrix, with approximately 50% of sugar content being present as fructose. Raisins are also rich in phenolic compounds which affect color, taste, and human health. (Signh et al 2009; Williamson and Carughi 2010) Fiber, fructose and phenolic content can all affect the human glycemic response following consumption. Phenolics and fiber are also associated with health benefits with respect to cardiovascular disease and cancer. All foods that contain carbohydrates will produce a transient increase in blood glucose following consumption. However, foods that excessively elevate blood glucose and insulin are often perceived negatively.

Raisins could provide health benefits with the additional consumer advantages of extended shelf-life and portability compared to fresh fruit. The shelf-life for bananas is approximately three days, grapes five days, and white bread fifteen days. Raisins have a shelf life of months which may make them appealing to persons seeking to increase fruit intake. This study sought to compare glycemic responses to standard serving sizes of bananas, white bread, raisins, and Thompson seedless grapes in healthy college are participants.

METHODS

This study was approved by the Winona State University Institutional Review Board. Healthy college aged students (ages 19 ± 1; male=12/female=47; BMI 24 ± 3). Participants were self described as healthy with specific exclusions including smoking, diabetes, cancer or cardiovascular disease. Participants arrived at the laboratory between 5 and 7 am following an overnight fast from all food and beverages except water.

Laboratory visits were made on one of three days. Upon arrival in the laboratory participants rested quietly for 25 minutes to allow for physiological baseline. A baseline finger stick blood sample was then collected (T-0) after which, participants were assigned to single serving sizes of bananas (n=17), white bread (n=13, Raisins (n=14), and Thompson seedless grapes (n=15) (Table 1), and asked to consume 50ml water with the test snack. Additional blood samples were collected T_{30}, T_{60}, and T_{120} after completion of the snack.

Accu-chek Advantage handheld blood glucose meters and Comfort wave test strips from a single manufactured lot number for uniformity were used in all experiemtns (Roche Diagnostics, Indianapolis, IN) were used to measure blood glucose. Area under the curve (AUC) values were obtained with the Prizm 5.0 software package (La Hoya, CA). Food composition estimates (Table 1) were based on www.nal. usda.gov/fnic/foodcomp for bananas, grapes, and raisins, and package labeling for white bread (Classic White, Sarah Lee, Downers Grove, IL.

Data expressed as mean ± SEM. Statistical analysis was determined with ANOVA, repeated measures modeling and least squares means ($p < 0.05$) using the Tukey-Kramer adjustment (SAS Inst. Inc., Cary, N.C., U.S.A.).

Figure1. Glycemic response of healthy college aged participants to single servings of bananas, grapes, raisins and bread. Statistical significance: * 0- vs 30-min, # 0-min vs 60 min .

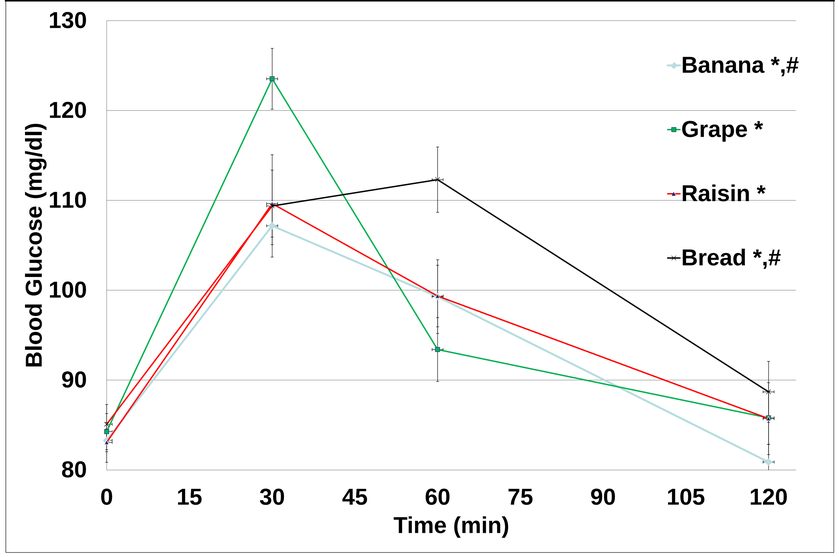

Figure 2. Individual blood glucose values for participants in receiving a single serving of bananas, grapes, raisins or bread.

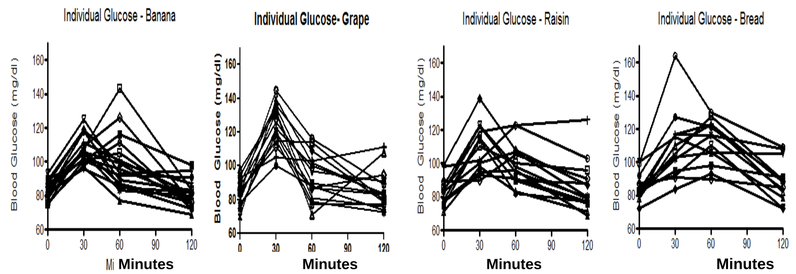

Figure 3. Plasma glucose area under the curve for participants in receiving a single serving of bananas, grapes, raisins or bread.

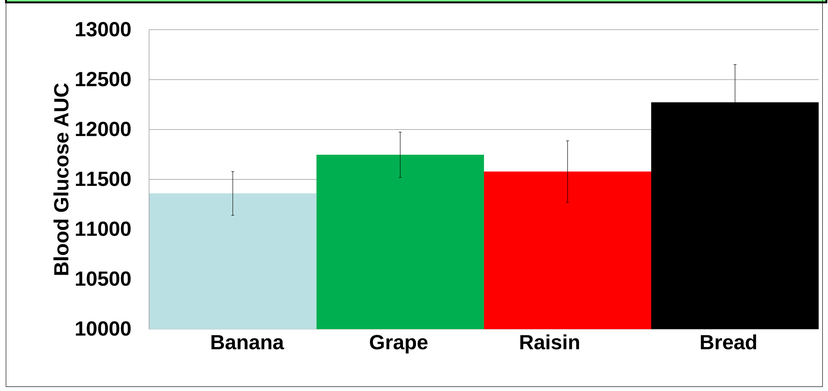

Table 1. Description of serving size and nutrient content of bananas, grapes, raisins and white bread.

	Banana	*White Bread*	*Thompson Seedless Grape*	*Raisin*
Treatment Source	Dole, Guatemala	Sarah Lee, Classic White	Columbine Vineyard, California	Sun-Maid, California
Serving Size (grams)	126	57	151	36
Source of Values	USDA	Package	USDA	USDA
Calories (Kcal)	112	160	435	108
Carbohydrates (grams)	28.8	30	120	28
Total Sugars (grams)	15	4.0	23	21
Dietary Fiber (grams)	3.3	1.0	1.4	1.3
Protein (grams)	1.4	5.0	1.1	1.1
Fat (grams)	0.4	1.6	0.2	0.2

SUMMARY OF MAIN POINTS:

1) Compared to baseline (T-0) blood glucose peaked at 30 minutes for bananas, grapes and raisins, and at 60 minutes for white bread.
2) Blood glucose values for WB displayed a delayed peak at 60 minutes which may be attributed to WB compression during the freezing process which may have slowed digestive passage.
3) By 120 minutes, participant blood glucose values had returned to near baseline for all treatments.
4) Glucose AUC values were not significantly different between treatments in spite of large differences in caloric intakes.
5) Continued studies in our laboratory will seek to analyze plasma insulin values associated with this study.

CONCLUSIONS

This study characterized the glycemic response of college-aged participants to several common fruit snacks and bread. It was found that RA had a glycemic response that was similar in comparison to TG, BA, and WB. Because of this, RA may be an attractive choice for improving fruit consumption in college-aged persons. Raisins should also be helpful because of their extended shelf life and portability. Choosing a definition of a “serving size” in terms of grams, calories, carbohydrate load, etc, remains a problem with respect to comparing fresh fruits, dried fruits and baked goods. This is especially a problem when real life servings sizes are considered for younger school aged persons.

REFERENCES

AP Singh, S Shah, MS Torres, N Vorsa, T Wilson. Raisin, currant and Thompson Seedless grape phenolic compound characterization using LC-MS-MS-ESI with product ion, precursor-ion, neutral–loss analysis and selected reaction monitoring. FASEB J. 2009; 23:718.3.

Williamson G, Carughi A. Polyphenol content and health benefits of raisins. Nutr Res. 2010;30:511-9.

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