

Glucose Monitoring After Fruit Peeling: Pseudohyperglycemia When Neglecting Hand Washing Before Fingertip Blood Sampling

Wash your hands with tap water before you check blood glucose level

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BG measurements

Capillary BG samples were collected from the healthy volunteers in the fasting state. BG levels were recorded using a portable glucose monitor (OneTouch UltraVue, Johnson and Johnson, New Brunswick, NJ).

Study design

Capillary blood samples were collected in the fasting state from healthy volunteers 1 h after they had peeled one of any of several kinds of fruits (orange, grape, or kiwi), followed by no hand washing no alcohol swab (Table 1, row 2), hand washing with tap water (Table 1, row 3), rubbing the fingertip with an alcohol swab once (Table 1, row 4) or five times (Table 1, row 5). In the control tests, blood samples were obtained from the fingertip after no fruit handling but rubbing the fingertip with an alcohol swab on the same day (Table 1, row 1). The samples were analyzed immediately with a portable glucose monitor. In this protocol, peeling the fruit involved holding the fruit in one hand and using either the fingers of the other hand or a kitchen peeling tool. In both experimental conditions, the skinless fruit was held in the hand after peeling. Blood samples were obtained from the hand that held the fruit.

Statistical analysis

Data are presented as median (interquartile range 25–75%). Data were analyzed using standard nonparametric analysis of variation (ANOVA), followed by Steel post hoc test to assess the significance between test condition 3 and other test conditions. All statistical tests were two-sided with 5% significant level.

RESULTS—The BG levels estimated by a BG monitor using fingertip blood samples obtained 1 h after peeling fruits, followed by washing hands with water, were similar to those of the control subjects (no peeling of fruits; rows 3 and 1,

OBJECTIVE—To examine whether hand contamination with fruit results in a false blood glucose (BG) reading using capillary fingertip blood sample.

RESEARCH DESIGN AND METHODS—The study subjects were healthy volunteers with normal glucose tolerance test. Capillary BG samples were collected from the fingertip after peeling orange, grape, or kiwi fruit, followed by no action, washing hands with tap water, or rubbing the fingertip with an alcohol swab, then analyzed with glucose monitors.

RESULTS—The BG levels measured after peeling any of the fruits, followed by washing hands, were similar to the control subjects (no fruit handling), but the levels after fruit peeling, followed by no washing, were abnormally and significantly high, even when the fingertip was cleaned once or five times with an alcohol swab before blood sampling.

CONCLUSIONS—To avoid overestimation of blood glucose using portable monitors, the hands should be washed before monitoring capillary BG, especially after fruit has been handled.

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Even though the value of self-monitoring of blood glucose (SMBG) in type 2 diabetes is controversial (1–3), there is no doubt that SMBG provides a strong motivation for improved self-care (4). Blood samples for SMBG are usually and easily obtained by a fingertip prick after the skin has been rubbed with an alcohol swab. However, abnormally high or low BG levels using blood from the fingertip have been reported. For example, underestimation of BG has been reported in the setting of impaired microcirculation, including low skin temperature (5,6). We also experienced overestimated BG levels in blood from the fingertip in patients

who had peeled fruit before SMBG. Fruits contain fructose and glucose, and traces of these sugars may be left on the fingertip after fruit peeling, thus resulting in an erroneous reading. We tested the hypothesis that serum glucose values will be higher after fruit peeling in those who do not wash their hands versus those who do.

RESEARCH DESIGN AND METHODS

Participants

The study recruited 10 healthy volunteers who were confirmed to be free of diabetes mellitus by oral glucose tolerance test.

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Table 1—Median blood glucose levels measured by a portable analyzer under different experimental conditions in 10 subjects with normal glucose tolerance

Test condition	Fruit peeling	Hand washing	Alcohol swab	Orange (n = 10)	Grape (n = 10)	Kiwi (n = 10)
1	—	—	1	98 (90.5–105.5)	93 (87.5–98.5)	89.5 (87–97.5)
2	+	—	—	171 (124–279)*	360 (276–600)*	183 (112–499.5)*
3	+	+	—	90 (83–96)	87 (79.5–102.5)	91.5 (86–96)
4	+	—	1	118 (110–159.5)*	274 (144–521)*	143.5 (119.8–298)*
5	+	—	5	119 (91–137.5)	131 (103.5–256)#	105.5 (95.75–146.5)#

Overscaled data (high, >600 mg/dL) were converted to 600 mg/dL to calculate median blood glucose level. Data are indicated as median (interquartile range: 25–75%). * $P < 0.01$. # $P < 0.05$ vs. test condition 3.

respectively, Table 1). However, fasting BG levels using fingertip blood samples obtained after peeling fruits that was not followed by hand washing were extremely high, regardless of whether the fingertip was or was not rubbed once with alcohol swab before sampling (Table 1, rows 4 and 2, respectively, compare with row 1). In particular, BG levels in some participants after peeling the skin of grape and kiwi were over the scale (Table 1, rows 2 and 4). Interestingly, even after rubbing the fingertip five times with the alcohol swab, the BG levels were still significantly high when the hand was not washed with water before blood sampling (grape and kiwi; Table 1, row 5). The same experiments with smaller numbers of participants were done using three different glucose monitors, and similar results were obtained (data not shown).

We believe the cause of these differences was from traces of glucose from the fruit on the finger. These results indicate that hand washing with tap water after peeling fruits, rather than the use of an alcohol swab, is very important for accurate monitoring of BG level using blood samples obtained by pricking the fingertip.

CONCLUSIONS—In this study we show the importance of washing hands

with tap water after fruit peeling for accurate BG monitoring using capillary blood from the fingertip. Erroneous BG levels were recorded when the participants did not wash their hands with water, and such false readings were still noted when hand washing was substituted with the use of an alcohol swab.

Unfortunately, a careful check of the instruction manuals of all glucose monitors available in Japan showed no recommendation in any of the manuals for hand washing with water before glucose monitoring using blood from the fingertip. We anticipate similar results when the hand is contaminated by sugar from fruit held in the hand while gradually biting if the hand is not later washed with water before blood sampling.

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