A Simple Meal Plan Emphasizing Healthy Food Choices Is as Effective as an Exchange-Based Meal Plan for Urban African Americans With Type 2 Diabetes

OBJECTIVE — To compare a simple meal plan emphasizing healthy food choices with a traditional exchange-based meal plan in reducing HbA1c levels in urban African Americans with type 2 diabetes.

RESEARCH DESIGN AND METHODS — A total of 648 patients with type 2 diabetes were randomized to receive instruction in either a healthy food choices meal plan (HFC) or an exchange-based meal plan (EXCH) to compare the impact on glycemic control, weight loss, serum lipids, and blood pressure at 6 months of follow-up. Dietary practices were assessed with food frequency questionnaires.

RESULTS — At presentation, the HFC and EXCH groups were comparable in age (52 years), sex (65% women), weight (94 kg), BMI (33.5), duration of diabetes (4.8 years), fasting plasma glucose (10.5 mmol/l), and HbA1c (9.4%). Improvements in glycemic control over 6 months were significant (P < 0.0001) but similar in both groups: HbA1c decreased from 9.7 to 7.8% with the HFC and from 9.6 to 7.7% with the EXCH. Improvements in HDL cholesterol and triglycerides were comparable in both groups, whereas other lipids and blood pressure were not altered. The HFC and EXCH groups exhibited similar improvement in dietary practices with respect to intake of fats and sugar sweetened foods. Among obese patients, average weight change, the percentage of patients losing weight, and the distribution of weight lost were comparable with the two approaches.

CONCLUSIONS — Medical nutrition therapy is effective in urban African Americans with type 2 diabetes. Either a meal plan emphasizing guidelines for healthy food choices or a low literacy exchange method is equally effective as a meal planning approach. Because the HFC meal plan may be easier to teach and easier for patients to understand, it may be preferable for low-literacy patient populations.

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such as the food exchange system, as
strategies to restrict energy intake and
provide macronutrient balance (25).
However, patients may have trouble un-
derstanding meal plans based on the ex-
change system (26), and discussion
groups in the Grady Health System in At-
tanta have shown the exchange system to
be difficult for this relatively low-literacy
(27) patient population (28). Because of
such potential barriers, some have recom-
manded that a more simplified approach
to dietary instruction, such as "eat less
fat," may be just as effective in the man-
agement of diabetes (29). Moreover, some
studies suggest that the essential elements
needed; at each of these appointments,
patients receive individualized, one-on-
one instruction in separate sessions. As
described previously (33), all patients are
managed with a stepped care protocol
that emphasizes nonpharmacologic ther-
dapy during the first 2 months. During this
period, antiobesity pharmacologic
agents are either discontinued or reduced
in dose for patients who are not ketosis
prone and do not have symptomatic hy-
perglycemia. If glycemic goals are not
reached after 2 months, pharmacother-
apy is re instituted or intensified.
Diabetes clinic patients were solicited
for participation in the study if they had
type 2 diabetes [classified according to ac-
cepted clinical criteria (33)], were able to
understand spoken English, had no major
complicating medical illnesses, and were
judged to be capable of performing basic
self-management skills. Patients were re-
cruited at their initial visit and random-
ized according to the day of their initial
visit (for logistical convenience) to receive
instruction in either a simplified ex-
change-based meal plan (EXCH group) or
a meal plan emphasizing healthy food
choices without discussion about losing
weight or limiting food intake (HFC
group); details about dietary instruction
are provided below. With the exception
of instruction in meal planning, patients
received all other management per the
standard protocol of the diabetes clinic.
The primary outcome was change in glo-
cemic control (HbA1c); secondary out-
comes included changes in fat and sugar
intake, BMI, lipids, and blood pressure.
The study was reviewed and approved by
the Emory University Institutional Re-
view Board.

Comparison of meal planning
approaches
The Diabetes Clinic dietitians were in-
volved in all phases of design and imple-
mentation of the study. Instruction for
each meal planning approach (EXCH or
HFC) and advice regarding general phys-
ical activity involved the same dietitian
time and the same personnel for each
group. Approximately 1 h was spent on
nutritional counseling at the initial visit
and 30 min at each of three subsequent
clinic visits. At each visit, individualized
patient instruction was based on 24-h re-
calls to direct dietary reinforcement.
Before enrolling participants in the study, a
curriculum outline was developed, and
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Laboratory analyses
Fasting plasma glucose was determined at
each visit, HbA1c, at intervals of 2 months,
and fasting lipids (secondary outcome) at
baseline and between 4 and 6 months.

RESEARCH DESIGN AND
METHODS
Setting and study paradigm
The Grady Health System Diabetes Clinic
serves an adult population (≥17 years of
age) that is primarily urban and African
American. A high proportion have in-
comes below the federal poverty line, lack
health insurance, and have poor func-
tional health literacy (27,33,34). Care is
provided by a team that includes nurses,
dietitians, podiatrists, and endocrinolo-
gists, and each patient’s initial visit in-
cludes an extensive evaluation and
education focused on self-care. After the
initial visit, patients are scheduled for re-
turn visits at 1, 2, and 4 weeks after the
initial visit and then at 2, 4, and 6 months.
All patients are routinely scheduled to see
a dietitian at the initial visit and at visits at
1, 2, and 4 weeks with additional visits as
needed; at each of these appointments,
patients receive individualized, one-on-
one instruction in separate sessions. As
described previously (33), all patients are
managed with a stepped care protocol
that emphasizes nonpharmacologic ther-
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Before enrolling participants in the study, a
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Laboratory analyses
Fasting plasma glucose was determined at
each visit, HbA1c, at intervals of 2 months,
and fasting lipids (secondary outcome) at
baseline and between 4 and 6 months.
HbA1c was measured using an high-performance liquid chromatography method (Diamat; Biorad, Hercules, CA). Glucose analyses used a glucose oxidase method (APEC, Danvers, MA). Triglycerides were measured with a Hitachi 717 instrument using a lipase/glycerol kinase/glycerol-3-phosphate method. Total cholesterol was determined with the same instrumentation using a cholesterol esterase and cholesterol oxidase reaction from Boehringer Mannheim Diagnostics (Mannheim, Germany). HDL cholesterol was assessed by the same method after precipitation of LDL and VLDL cholesterol. LDL cholesterol was calculated using the Friedewald equation (38).

Statistical analysis

Data were analyzed using Statview II (Abacus Concepts, Berkeley, CA). Student’s t test and Mann-Whitney U test were used to test differences in baseline characteristics. χ² analyses were used to compare categorical data. ANOVA with repeated measures was used for follow-up data; only patients with values at every time point were included in these analyses. Spearman rank correlation analysis was used to test changes in triglyceride levels. Chronbach’s α and logistic regressions were performed using STATA Statistical Software (Stata, College Station, TX).

RESULTS

Patient characteristics

Between August 1994 and August 1995, 648 patients with initial visits to the Grady Diabetes Clinic qualified and agreed to participate in the study; 359 were assigned to the EXCH group and 289 to the HFC group. A small number of patients later requested to switch from the HFC to the EXCH group for the purpose of weight management, but in all case subjects, data were analyzed on the basis of intention to treat.

The presenting population had a mean age of 52 years, 90% were African American, 65% were women, and 78% were obese (>120% ideal weight, Table 1). The mean duration of diabetes was 4.8 years, the initial fasting plasma glucose 10.5 mmol/l, and HbA1c 9.4%. There were no significant differences between the EXCH and HFC groups in age, ethnicity, gender, BMI, duration of diabetes, fasting glucose, or HbA1c. The EXCH group had a higher follow-up rate at 2 months (59 vs. 51%, P = 0.03) but not at 6 months (48 vs. 52%, P > 0.2). Such follow-up rates are characteristic of this patient population and reflect barriers to care that are not unusual in patient groups that are confronted with poverty and low literacy (27,33,34). In both groups, the patients who returned for their 6-month visits had comparable demographic characteristics at baseline (see Table 1, “6-month return” groups).

On presentation, 19% of patients were being managed with meal plan alone, 44% were using sulfonylureas, 34% were using insulin only, and 3% were using sulfonylureas and insulin in combination (Table 1). The percentage of

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Table 1—Presenting characteristics of study population, including all subjects at baseline and those with laboratory studies available from return visits after 6 months of follow-up care

<table>
<thead>
<tr>
<th></th>
<th>EXCH Initial</th>
<th>HFC Initial</th>
<th>P</th>
<th>EXCH 6-month return</th>
<th>HFC 6-month return</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>359</td>
<td>289</td>
<td></td>
<td>126</td>
<td>94</td>
<td></td>
</tr>
<tr>
<td>Sex (F/M)</td>
<td>243/116</td>
<td>180/109</td>
<td>0.15*</td>
<td>92/34</td>
<td>67/27</td>
<td>0.78*</td>
</tr>
<tr>
<td>Race (%)</td>
<td></td>
<td></td>
<td>0.42*</td>
<td></td>
<td></td>
<td>0.42*</td>
</tr>
<tr>
<td>African American</td>
<td>90.3</td>
<td>89.6</td>
<td></td>
<td>85.7</td>
<td>89.4</td>
<td></td>
</tr>
<tr>
<td>Caucasian</td>
<td>7.5</td>
<td>9.7</td>
<td></td>
<td>11.1</td>
<td>9.6</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>2.2</td>
<td>0.7</td>
<td></td>
<td>3.2</td>
<td>1.1</td>
<td></td>
</tr>
<tr>
<td>Therapy (%)</td>
<td></td>
<td></td>
<td>0.87*</td>
<td></td>
<td></td>
<td>0.68*</td>
</tr>
<tr>
<td>Meal plan only</td>
<td>20.3</td>
<td>18</td>
<td></td>
<td>22.2</td>
<td>16.0</td>
<td></td>
</tr>
<tr>
<td>Sulfonylurea</td>
<td>43.5</td>
<td>45.7</td>
<td></td>
<td>41.3</td>
<td>44.7</td>
<td></td>
</tr>
<tr>
<td>Insulin</td>
<td>33.4</td>
<td>33.9</td>
<td></td>
<td>32.5</td>
<td>36.2</td>
<td></td>
</tr>
<tr>
<td>Both</td>
<td>2.8</td>
<td>2.4</td>
<td></td>
<td>4</td>
<td>3.2</td>
<td></td>
</tr>
<tr>
<td>Obese (%)</td>
<td>77</td>
<td>80.3</td>
<td>0.32*</td>
<td>69.8</td>
<td>79.8</td>
<td>0.09*</td>
</tr>
<tr>
<td>Age (years)</td>
<td>52 ± 0.7</td>
<td>52 ± 0.8</td>
<td>0.96</td>
<td>57.5 ± 1.0</td>
<td>55.2 ± 1.3</td>
<td>0.14</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>33.7 ± 0.5</td>
<td>33.2 ± 0.4</td>
<td>0.41</td>
<td>32.1 ± 0.7</td>
<td>32.9 ± 0.8</td>
<td>0.41</td>
</tr>
<tr>
<td>Duration (years)</td>
<td>4.8 ± 0.4</td>
<td>4.9 ± 0.4</td>
<td>0.95</td>
<td>6.2 ± 0.7</td>
<td>5.3 ± 0.8</td>
<td>0.39</td>
</tr>
<tr>
<td>Fasting glucose (mmol/l)</td>
<td>10.3 ± 0.23</td>
<td>10.7 ± 0.25</td>
<td>0.26</td>
<td>10.8 ± 0.4</td>
<td>10.3 ± 0.4</td>
<td>0.37</td>
</tr>
<tr>
<td>HbA1c (%)</td>
<td>9.32 ± 0.1</td>
<td>9.57 ± 0.2</td>
<td>0.23</td>
<td>9.46 ± 0.20</td>
<td>9.69 ± 0.25</td>
<td>0.46</td>
</tr>
<tr>
<td>Blood pressure (mmHg)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Systolic</td>
<td>127.5 ± 11</td>
<td>128.8 ± 11</td>
<td>0.43</td>
<td>130.3 ± 1.7</td>
<td>128.8 ± 1.8</td>
<td>0.56</td>
</tr>
<tr>
<td>Diastolic</td>
<td>77.7 ± 0.6</td>
<td>77.9 ± 0.6</td>
<td>0.79</td>
<td>77.9 ± 0.9</td>
<td>76.5 ± 0.9</td>
<td>0.29</td>
</tr>
<tr>
<td>LDL cholesterol (mmol/l)</td>
<td>3.62 ± 0.06</td>
<td>3.7 ± 0.07</td>
<td>0.26</td>
<td>3.85 ± 0.1</td>
<td>3.74 ± 0.12</td>
<td>0.46</td>
</tr>
<tr>
<td>HDL cholesterol (mmol/l)</td>
<td>1.11 ± 0.02</td>
<td>1.10 ± 0.02</td>
<td>0.61</td>
<td>1.12 ± 0.03</td>
<td>1.12 ± 0.03</td>
<td>0.9</td>
</tr>
<tr>
<td>Triglycerides (mmol/l)</td>
<td>1.75 ± 0.07</td>
<td>2.12 ± 0.15</td>
<td>0.14†</td>
<td>1.91 ± 0.17</td>
<td>1.89 ± 0.16</td>
<td>0.70†</td>
</tr>
<tr>
<td>C-peptide (mmol/l)</td>
<td>0.89 ± 0.08</td>
<td>0.90 ± 0.03</td>
<td>0.85</td>
<td>0.87 ± 0.04</td>
<td>0.90 ± 0.05</td>
<td>0.61</td>
</tr>
</tbody>
</table>

Data are means ± SEM or %. Comparisons are by unpaired Student’s t test, except where indicated by * (χ²) or † (Mann-Whitney U test).
Healthy food vs. exchange meal plan

patients managed with meal plan alone increased to 38% at 2 months (reflecting a vigorous trial of nonpharmacologic management for obese patients, see RESEARCH DESIGN AND METHODS) and then decreased gradually to 28% at 6 months. There was no difference in the distribution of therapies between the two groups at any time point (all \( \chi^2 \) tests, \( P > 0.15 \)).

Changes in fat and sugar intake

We used questionnaires to determine whether the EXCH versus HFC approaches to dietary instruction led to differences in eating patterns. Reliability of the modified Kristal fat screener in this population was comparable with that reported by Kristal et al. (39); Chronbach’s \( \alpha \)'s were generally 0.5 to 0.7 for initial evaluations with all of our questionnaires. At baseline, the EXCH and HFC groups had comparable fat intake as measured by the food frequency and Kristal fat screener. During follow-up, both groups decreased their fat intake (\( P < 0.01 \) for all but the HFC meal plan on the Kristal scale (\( P = 0.07 \))). Use of sugar-containing foods was comparable in the two groups initially (\( P = 0.09 \)), and decreases were significant but similar in both groups (\( P < 0.01 \) for both changes). Change in food usage was not a significant predictor of change in HbA1c, whether it was tested in univariate analysis or in a multiple regression model that included age, duration of diabetes, sex, ethnicity, BMI, and metabolic variables (data not shown).

Changes in HbA1c

HbA1c declined comparably for both groups over the 6 months of follow-up, dropping from 9.6 to 7.7% in the EXCH group and 9.7 to 7.8% in the HFC group (\( P < 0.0001 \) for both) (Fig. 1A). At 6 months, 41% of the EXCH group and 32% of the HFC group had achieved a HbA1c of 7.0% or less (\( P = 0.12 \) between groups). Decreases in glucose levels were also comparable between the groups (\( P > 0.5 \), data not shown) with fasting glucose declining from 10.8 to 9.2 mmol/l for the EXCH group, and 9.9 to 9.0 mmol/l for the HFC group (\( P < 0.0001 \) for each change). In both groups, responses were similar for patients who were classified as lean or obese (data not shown).

Changes in weight

Results were evaluated for the 275 patients classified as obese (>120% of ideal weight) who returned for their 2-month follow-up appointment (158 EXCH and 117 HFC) and the 155 who returned for all three of their bi-monthly appointments (86 EXCH and 69 HFC). The EXCH and the HFC groups did not differ significantly in the percentage of patients who lost weight (53.2 vs. 53.0%, \( P > 0.97 \)) or in the distribution of patients who lost weight (0–5, 5–10, 10–15, or >15 lb (0–2.3, 2.3–4.5, 4.5–6.8, or >6.8 kg) by the 2-month follow-up visit. Both groups had small but significant average weight change at 6 months (\( P = 0.02 \) for both). The average weight of the EXCH group increased from 96.4 to 96.8 kg, and that of the HFC group declined from 95 to 94.1 kg; 59.7% of the EXCH and 45.1% of the HFC group gained weight (\( P = 0.07 \) between groups). Neither weight nor BMI was significantly different between the two groups at 6 months (\( P = 0.15 \)). Changes in weight among the patients classified as obese were not significantly related to changes in fat or sugar usage or to dietary assignment group even by univariate analysis or in the multiple regression model. A small but significant increase in weight also occurred in patients classified as lean with the EXCH group gaining 2.3 kg and the HFC gaining 3.6 kg (\( P < 0.0001 \)).

Lipids and blood pressure

Information on lipids was available for 638 patients at baseline and for 169 patients who had repeat measurements at the 4- or 6-month return visit. There was no systematic strategy to repeat lipid measurements or to institute or alter use of hypolipidemic agents. Neither total nor LDL cholesterol differed significantly between the groups on initial presentation, and values did not change significantly over time (all \( P > 0.15 \)). HDL cholesterol increased slightly but significantly in both groups (from 1.09 to 1.15 mmol/l in EXCH and from 1.11 to 1.17 mmol/l in HFC; \( P < 0.005 \) for both). Average triglycerides dropped from 2.03 to 1.78 mmol/l in the EXCH group and from 2.92 to 2.38 mmol/l in the HFC group (\( P < 0.001 \) for both). Blood pressure did not differ significantly between the EXCH and HFC groups at initial presentation or after 6 months of follow-up (data not shown).

CONCLUSIONS — Medical nutrition therapy is essential in the management of type 2 diabetes. Moreover, effective medical nutrition therapy will be particularly important for populations such as that served by the Grady Health System in which diabetes and obesity are common, glycemic control on presentation is often poor (Table 1), and many patients already have diabetes complications (33,40,41). However, there has been relatively little examination of different nutritional approaches for urban populations enriched in minorities, the poor, and the underserved (25). In this setting, we found that instruction in meal planning based only on HFC was comparable with the EXCH system in impact on food selection, glycemic control, weight, lipids, and blood pressure. Although the additional benefits of weight loss should not be discounted (42,43), the data indicate that nutritional management for patients with type 2 diabetes does not need to be focused primarily on weight loss or to involve exchange approaches to have a beneficial impact on glycemic control. Since changes in lipids were small with both approaches, our findings also raise the possibility that neither the EXCH nor the HFC meal plan will constitute an effective first-line method for modifying these important cardiovascular risk factors in municipal populations; if LDL cholesterol abnormalities persist despite improve-
ments in glycemic control (44), patients may need earlier institution of hypolipidemic agents.

The lack of difference in outcomes between the EXCH and HFC approaches may be due to similarities in food usage; both groups had comparable fat and sugar intakes at baseline and reported significant but comparable reductions in fat and sugar intake at follow-up. It should be recognized that even though others have used similar approaches to evaluate dietary intake (36,45), such self-reports might not always be accurate reflections of actual dietary composition and energy intake (45–52). However, to the extent that the HFC approach produces comparable outcomes but is easier to understand and easier to teach than the EXCH approach, the HFC approach may be preferable for use in urban populations with low literacy such as that served by Grady (27).

One limitation of this study is that we did not assess patient satisfaction with either meal plan. However, patients reported anecdotally that the HFC meal plan was easy to understand, which contrasts with the difficulty patients may have with the EXCH meal plan (28). We also did not evaluate ease of use, but the dietitians reported anecdotally that the HFC meal plan was easier to teach. Although portion sizes were not discussed with patients in the HFC meal plan, it is possible that they were implied from demonstration of the food pyramid and use of food models. While the EXCH and HFC groups had comparable demographic characteristics and return rates, it remains possible that the substantial dropout rate led to some selection bias. However, a comparable dropout was recently reported for a diabetes education program that used a similar randomization scheme but was based in a suburban setting (53). Finally, it was not possible to obtain data on the cost of our interventions or on patient socioeconomic status, education, or literacy. However, demographic characteristics of the patients were otherwise similar between study groups and to what we have previously reported (33) with no obvious change in referral patterns.

Instruction in both meal plans, and the observed improvement in glucose control, occurred in the context of our general treatment program. Nonetheless, the reductions in HbA1c under the HFC meal plan can be seen as further support for the idea that emphasizing food choices, and not just energy intake, can be an important element in improving glycemic control. As a result of this study, providers in the Grady Diabetes Clinic continue to use the EXCH meal plan for those patients who desire a focus on food exchanges and portion sizes as a strategy to lose weight, but instruction in HFC without an emphasis on weight loss has become the standard approach to meal planning for all other patients.

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References

Healthy food vs. exchange meal plan


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