機能性の科学的根拠に関する点検表（新様式・2009 準拠版）

１．製品概要

商品名	血糖ファイバーb
機能性関与成分名	グアーガム分解物（食物繊維）
表示しようとする機能性	本品にはグアーガム分解物（食物繊維）が含まれるので、糖の吸収をおだやかにし、食後血糖のピーク値を抑えます。

２．科学的根拠

【臨床試験（ヒト試験）及び研究レビュー共通事項】

□（主観的な指標によってのみ評価可能な機能性を表示しようとする場合）当該指標は日本人において妥当性が得られ、かつ、当該分野において学術的に広くコンセンサスが得られたものである。

□（最終製品を用いた臨床試験（ヒト試験）又は研究レビューにおいて、実際に販売しようとする製品の試作品を用いて評価を行った場合）両者の間に同一性が失われていないことについて、届出資料において考察されている。

☑最終製品を用いた臨床試験（ヒト試験）

（研究計画の事前登録）

☑公開データベースに事前登録している[注1]。

（臨床試験（ヒト試験）の実施方法）

□「特定保健用食品の表示許可等について」（平成 26 年 10 月 30 日消食表第 259 号）の別添２「特定保健用食品申請に係る申請書作成上の留意事項」に示された試験方法に準拠している。

☑科学的合理性が担保された別の試験方法を用いている。

→☑別紙様式（Ｖ）－２を添付

（臨床試験（ヒト試験）の結果）

☑国際的にコンセンサスの得られた指針に準拠した論文を添付している[注1]。

□査読付き論文として公表されている論文を添付している。

□（英語以外の外国語で書かれた論文の場合）論文全体を誤りのない日本語に適切に翻訳した資料を添付している。

☑研究計画について事前に倫理審査委員会の承認を受けたこと、並びに当該倫理審査委員会の名称について論文中に記載されている。

□（論文中に倫理審査委員会について記載されていない場合）別紙様式（Ｖ）－３で補足説明している。

☑掲載雑誌は、著者等との間に利益相反による問題が否定できる。

□最終製品に関する研究レビュー
□機能性関与成分に関する研究レビュー

- □（サプリメント形状の加工食品の場合）摂取量を踏まえた臨床試験（ヒト試験）で肯定的な結果が得られている。
- □（その他加工食品及び生鮮食品の場合）摂取量を踏まえた臨床試験（ヒト試験）又は観察研究で肯定的な結果が得られている。

□海外の文献データベースを用いた英語論文の検索のみではなく、国内の文献データベースを用いた日本語論文の検索も行っている。

□（機能性関与成分に関する研究レビューの場合）当該研究レビューに係る成分と最終製品に含有されている機能性関与成分の同等性について考察されている。

□（特定保健用食品の試験方法として記載された範囲内で軽症者等が含まれたデータを使用している場合）疾病に罹患していない者のデータのみを対象とした研究レビューも併せて実施し、その結果を、研究レビュー報告書に報告している。

□（特定保健用食品の試験方法として記載された範囲内で軽症者等が含まれたデータを使用している場合）疾病に罹患していない者のデータのみを対象とした研究レビューも併せて実施し、その結果を、別紙様式（Ⅰ）に報告している。

□表示しようとする機能性の科学的根拠として、査読付き論文として公表されている。

□当該論文を添付している。

□（英語以外の外国語で書かれた論文の場合）論文全体を誤りのない日本語に適切に翻訳した資料を添付している。

- □PRISMA 声明（2009 年）に準拠した形式で記載されている。
- □（PRISMA 声明（2009 年）に照らして十分に記載できていない事項がある場合）別紙様式（Ⅴ）－３で補足説明している。
- □（検索に用いた全ての検索式が文献データベースごとに整理された形で当該論文に記載されていない場合）別紙様式（Ⅴ）－５その他の適切な様式を用いて、全ての検索式を記載している。
- □（研究登録データベースを用いて検索した未報告の研究情報についてその記載が当該論文にない場合、任意の取組として）別紙様式（Ⅴ）－９その他の適切な様式を用いて記載している。
- □食品表示基準の施行前に査読付き論文として公表されている研究レビュー論文を用いているため、上記の補足説明を省略している。

□各論文の質評価が記載されている[注2]。

□エビデンス総体の質評価が記載されている[注2]。

□研究レビューの結果と表示しようとする機能性の関連性に関する評価が記載されている[注2]。

□表示しようとする機能性の科学的根拠として、査読付き論文として公表されていない。

研究レビューの方法や結果等について、

□別紙様式（Ⅴ）－４を添付している。

□データベース検索結果が記載されている[注３]。

□文献検索フローチャートが記載されている[注３]。

□文献検索リストが記載されている[注３]。

□任意の取組として、未報告研究リストが記載されている[注３]。

□参考文献リストが記載されている[注３]。

□各論文の質評価が記載されている[注３]。

□エビデンス総体の質評価が記載されている[注３]。

□全体サマリーが記載されている[注３]。

□研究レビューの結果と表示しようとする機能性の関連性に関する評価が記載されている[注３]。

注１　食品表示基準の施行後１年を超えない日までに開始（参加者１例目の登録）された研究については、必須としない。

注２　各種別紙様式又はその他の適切な様式を用いて記載（添付の研究レビュー論文において、これらの様式と同等程度に詳しく整理されている場合は、記載を省略することができる。）

注３　各種別紙様式又はその他の適切な様式を用いて記載（別紙様式（Ⅴ）－４において、これらの様式と同等程度に詳しく整理されている場合は、記載を省略することができる。）

別紙様式（Ｖ）－３【添付ファイル用】

表示しようとする機能性の科学的根拠に関する補足説明資料

１．製品概要

商品名	血糖ファイバーｂ
機能性関与成分名	グアーガム分解物（食物繊維）
表示しようとする機能性	本品にはグアーガム分解物（食物繊維）が含まれるので、糖の吸収をおだやかにし、食後血糖のピーク値を抑えます。

２．補足説明

当該製品と臨床試験論文で使用した製品の同一性に関する説明

臨床試験にて使用した被験食品は、グアーガム分解物単一原料であり、当該製品も同様にグアーガム分解物単一原料からなる。被験食品 4g に含まれる機能性関与成分量（食物繊維）3g を下限値として担保するため、当該製品の一日摂取目安量を 4.4g としたが、内容物はグアーガム分解物のみで、かつ製造工程および剤形も被験食品と同一である。食後血糖のピーク値を抑える機能はグアーガム単一原料 6.7g 摂取した場合でも確認されている（原料メーカー保有データ）。従って、グアーガム分解物単一原料 4g～6.7g では本臨床試験と同様の結果が得られると考えられるので、当該製品も被験食品と同様の機能があるといえる。

薬理と治療（JPT）
JAPANESE PHARMACOLOGY & THERAPEUTICS（国際文献略号 *Jpn Pharmacol Ther*）
2016年1月20日発行　vol.44 no.1　別刷

Effect of Partially Hydrolyzed Guar Gum on Postprandial Hyperglycemia

—A Randomized Double-blind, Placebo-controlled Crossover-study—

■

Makoto Tokunaga　Zenta Yasukawa
Makoto Ozeki　Jiro Saito

ライフサイエンス出版
TEL（03）3664-7900（代表）

Effect of Partially Hydrolyzed Guar Gum on Postprandial Hyperglycemia

—A Randomized Double-blind, Placebo-controlled Crossover-study—

Makoto Tokunaga[1)] Zenta Yasukawa[1)]
Makoto Ozeki[1)] Jiro Saito[2)]

ABSTRACT

Objectives The aim of this study was to evaluate the efficacy of partially hydrolyzed guar gum (PHGG)-containing supplement on the postprandial increase in blood glucose level in subjects with moderate postprandial hyperglycemia.

Methods Volunteers (70 subjects) with their fasting blood glucose levels of 71-118 mg/dL and postprandial blood glucose levels of 141-194 mg/dL were enrolled in a randomized, double-blind, placebo-controlled, crossover-study. Subjects ingested high-carbohydrate meal (115.6 g carbohydrate) together with either test supplement containing 4 g PHGG as 3 g dietary fiber or placebo supplement. Blood glucose and insulin levels were determined before and 30, 60, 90 and 120 minutes after the meal ingestion.

Results The intake of PHGG supplement resulted in a significant decrease in postprandial blood glucose level compared to the level in placebo group. The area under the curve (AUC) for blood glucose level was 277.8±5.3 mg·h/dL (mean±SE) for PHGG group and 285.3±6.0 mg·h/dL for placebo group (P=0.043). Furthermore C_{max} for blood glucose level was 168.1±3.0 mg/dL (mean±SE) for PHGG group and 174.1±3.3 mg/dL for placebo group (P=0.004).

Conclusions The ingestion of PHGG supplement alleviates postprandial hyperglycemia.

(Jpn Pharmacol Ther 2016；44：85-91)

KEY WORDS Partially hydrolyzed guar gum, Postprandial hyperglycemia, Insulin

INTRODUCTION

Recently, the number of diabetic patients has been increasing in Japan as a result of lifestyle changes, such as westernized diets and lack of exercise, which accompanies an increase in obesity. In fact, 16.2% of males and 9.2% of females are strongly suspected to be diabetic, and the possibility of diabetes cannot be ruled out in the additional 10% in both male and female.[1)]

Diabetes is one of the lifestyle diseases and it may trigger complications such as retinopathy, ischemic disease, and hyperlipidemia. These diseases significantly decrease patients' QOL, which leads to an increase in national health care costs.

For this reason, food materials that have a suppressive effect on postprandial blood glucose levels have been studied to prevent the onset of diabetes. To date, the followings food materials have been reported to have suppressive effects on postprandial blood glucose levels: guava leaf polyphenol, indigestible dextrin, fermented black bean extract, and guar gum.[2-5)]

Guar gum is a polymer obtained from the endo-

[1)]Taiyo Kagaku Co., Ltd. [2)]Medical Station Clinic

sperm of guar beans grown in India and Pakistan regions.[6] The dietary fibers in guar gum cannot be digested by human digestive enzymes, and therefore cannot be consumed in large quantities. The physical properties of guar gum, such as low solubility and high viscosity, have been an obstacle for food application. Thus, we developed partially hydrolyzed guar gum (PHGG) by partly hydrolyzing guar gum enzymatically. This helped alleviate some of the weaknesses associated with guar gum to food application. In this study, we examined the suppressive effects of PHGG ingestion on an increase in postprandial blood glucose levels in both male and female. This was a randomized double-blind, placebo-controlled cross-over study. The subjects recruited showed a tendency of having an increased level of postprandial blood glucose.

SUBJECTS AND METHODS

1 Subjects

Subjects were recruited on November 2014. Subjects were healthy volunteers, 20-64 (44.7±1.4) years old male and female, who were paid for participation. They received explanatory documents and consent forms approved by the ethics committee. In accordance with Helsinki Declaration, the purpose of the study, advantage and disadvantage of participating in the study, and compensation were fully explained to participants. They voluntarily provided written consent prior to their preliminary checkup.

The candidates were requested to record life documents 3 days prior to the preliminary checkup. Lifestyle survey, physical condition check, measurements, fasting clinical test (blood/urine), placebo food ingestion, and meal tolerance tests were conducted. Among the candidates with fasting blood glucose level of below 126 mg/dL, 140 mg/dL or above, and below 200 mg/dL 30 minutes after meal ingestion, 70 subjects (32-male, 38-female) were selected by the principle investigator. Based on an exclusion criteria implemented prior to the test, the following subjects were excluded from the test: those who participated in other clinical tests within 1 month of obtaining consent or scheduled to participate in other clinical test after obtaining the consent; pregnant woman or lactating woman (including those who are expecting a child); those who regularly ingest food or pharmaceutical products that are rich in related dietary fiber; those who use pharmaceutical products or designated health foods that may influence glycolysis; those who currently have serious diseases such as diabetes, liver disease, kidney disease, heart disease, or with a history of such diseases; those who are currently under treatment or with a medical history of serious disease which requires medication; those who may have an allergic reaction against the test supplement; those who were determined to be unfit for the test based on clinical test, physical examination, and survey results; those who were determined to be unfit for the test by the principle investigator.

During the test period, subjects were requested to maintain the same lifestyle as before participating in the test, and advised not to overly exceed the normal range of exercise, abstemious diet, or overeating. They were also requested to eliminate the intake of health foods and supplements during the test period. No alcohol consumption was allowed one day and two days prior to the test. Subjects were requested to complete supper by 8 pm the day before the test, and they were only allowed to drink water or tepid water after supper. Subjects were requested to consume a designated meal for supper the day before the ingestion test. Subjects were also requested to keep life records, including the change of their physical condition and the use of pharmaceutical products 7 days prior to the test, along with meal records 3 days prior to the test.

The termination criteria were as follows: When the safety of subjects is not warranted; when the continuation of the test is difficult due to the occurrence of serious clinical abnormality or accidents; when subjects disobey the study guidance significantly; when the principle investigator determines the termination of the test to be appropriate. Under these circumstances, the case was regarded as a terminated case. When a subject decided to dropout at his/her own free will, the case was treated as a dropout case.

Among 70 subjects, there were no terminated cases. Two subjects dropped out during the test period. One was for his/her own convenience and the other was a decision made by the principle investigator due to the subject's aggravated health condition. A total of 68 subjects completed the test. Among them, 2 subjects displayed behavior or events that may deteriorate the reliability of the test results, 4 subjects failed to follow restrictions, and 7 subjects displayed large fluctuation in test values. These 12 subjects (1 redundant subject) were excluded from the analysis because of the exclusion criteria set prior to the study. Thus, we only analyzed 56 subjects for validity analysis. All 70 subjects, those who consumed the test supplement at least once, were targeted for safety analysis (**Fig. 1**).

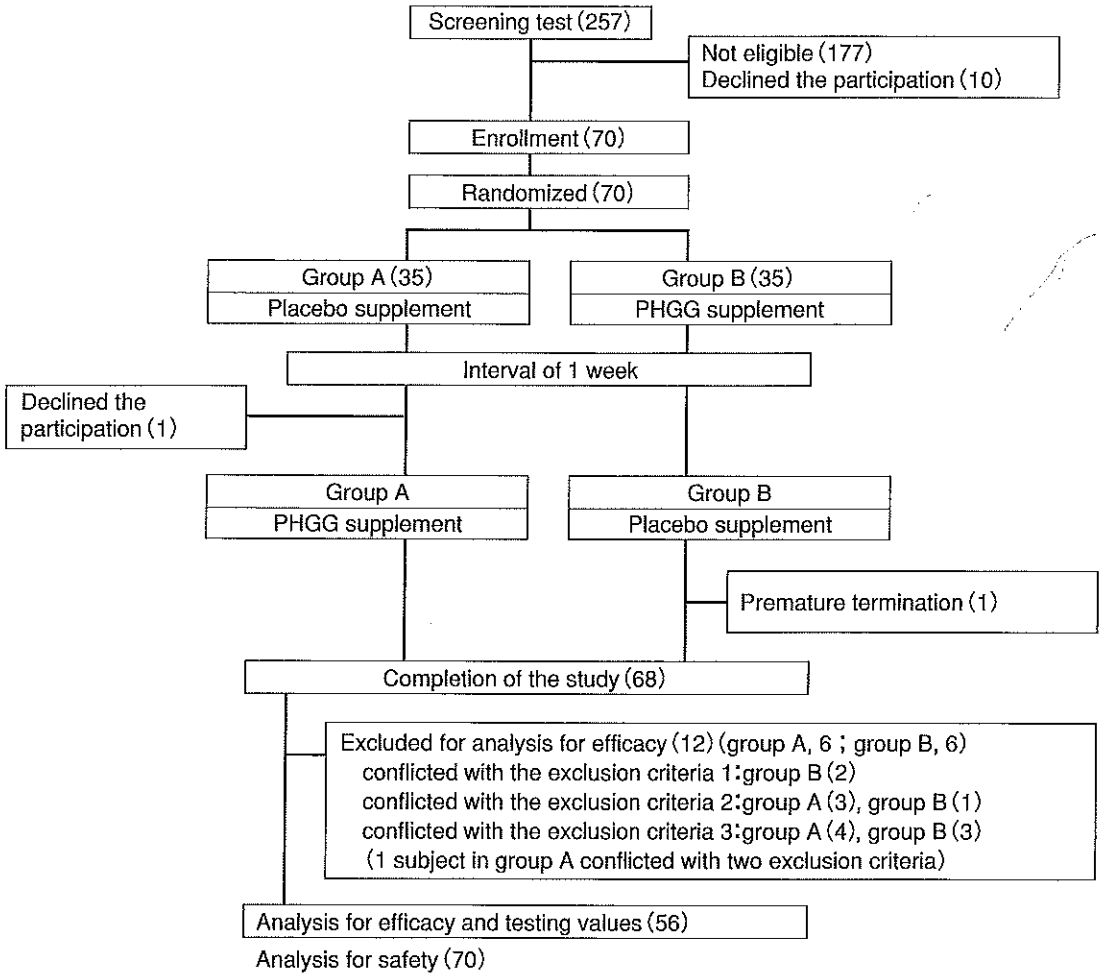

Fig. 1 Outline of the study

2 Test supplement and test methods

1）Test supplement (PHGG and placebo supplement)

In the present study, PHGG 4 g (containing 3 g dietary fiber) and dextrin 4 g were chosen as the PHGG and placebo supplement, respectively. Prior to the test, we confirmed that the two supplements could not be distinguished by appearance or flavor.

2）Loading food

Cooked rice 300 g (brand name: Sato no Gohan, a large serving of Koshihikari from Niigata, Sato Foods Industries Co., Ltd) was used as a loading food whereas materials for Oyako-don, a bowl of rice with chicken, egg, and vegetables (brand name: Donburi-tei, Oyako-don, Ezaki Glico Co., Ltd) was used as supplement food. Total components of the loading food and supplement food consisted of 18.7 g protein, 3.2 g lipid and 115.6 g carbohydrate, providing 575 kcal of energy.

3）Ingestion methods

One package of the PHGG supplement or placebo supplement (4 g) was ingested with the loading food within 10 minutes.

4）Ingestion test

The present study was conducted in accordance with the Helsinki Declaration and based on the ethics guideline for epidemiological study (Notice from the Ministry of Education, Culture, Sports, Science and Technology and the Ministry of Health, Labor, and Welfare, partially revised on December 1st, 2008). The test plan was examined by the ethics committee of Ueno Clinic, Aisei Hospital, Public Interest Incorporated Foundation, and approved on October 30th, 2014. The test was conducted as a randomized, double-blind, placebo-controlled, crossover-study at the Medical Station Clinic (Minato-ku, Tokyo, conducted in Meguro-ku after 2015) between November 2014 and March 2015.

Allocation table was prepared using random numbering. Each test supplement was assigned with an allocation number. The allocation table was sealed and the data was disclosed after fixing the targets for analysis and data. The person in charge at Taiyo Kagaku Co. Ltd

blinded samples.

Subjects were randomly assigned into 2 groups (Group A and Group B) before starting the test. The person in charge at Total Technological Consultant Co., Ltd. (TTC Co., Ltd.) conducted enrollments and assignments. The placebo supplement was ingested together with the loading food in Group A, whereas the PHGG food was ingested during ingestion period I in Group B. During ingestion period II, the PHGG food was ingested in Group A and placebo food was ingested in Group B in the same manner. The washout period was one week between ingestion periods I and II. Each Group consisted of 28 subjects.

On the day of the test, subjects were requested to fast for at least 10 hours before visiting the testing institute. After a physical checkup, measurement, and fasting blood collection, subjects were requested to ingest loading food with the PHGG supplement or placebo supplement within 10 minutes. No drinking and eating were allowed except for water or tepid water, and they were requested to rest in a sitting position. Blood was collected 30, 60, 90, and 120 min after the start of the meal tolerance test. The levels of blood glucose and insulin were measured at BML Inc. according to a routine method.

3 Evaluation items and methods

1) Validity evaluation

(1) Primary endpoints: area under the curve (AUC) and the maximum value (C_{max}) of the blood glucose after ingesting the loading food.

(2) Secondary endpoints: fast blood glucose/insulin level, and after 30, 60, 90, and 120 min after ingesting loading food.

2) Safety evaluation

The principle investigator determined the occurrence of adverse events (all medically unfavored events, newly discovered or aggravated in subjects after the ingestion of the test supplement, such as subjective symptoms, objective symptoms, and abnormal fluctuations of test values). Adverse events were evaluated regardless of the association with the test supplement, and determined according to the following criteria: seriousness (serious or non-serious), degree (mild, medium or severe), association (absent, likely absent, maybe present or present) and outcome (recovery, improvement, without change, aggravation, death, unknown). When the association of the symptom with the PHGG supplement could be fully ruled out, the event was considered to be a secondary effect.

4 Statistical analysis

Once we confirmed that the effects of both testing order and date on the AUC of blood glucose are not statistically significant, we conclude that the data from the crossover design in this study is appropriate for further analysis by ANOVA. Numerical values are shown in mean±SEM and the level of significance was set at 5% by two-tailed test. PASW statistics 18 (SPSS Co. Ltd.) was used for statistical analysis, which was conducted by TTC Co., Ltd.

RESULT

1 Background of subjects

Table 1 shows the baseline data (gender, age, height, weight, BMI, fasting blood glucose level, postprandial blood glucose level 30 min after loading food ingestion, AUC and C_{max} of blood glucose level) of the 56 subjects for validity analysis (28-male, 28-female). The range of age for the subjects were 20-64 (45.4±1.5) years old, fasting blood glucose level was 71-118 mg/dL, and the postprandial blood glucose level 30 min after ingesting loading meal was 141-194 mg/dL. A significant difference was found between Group A and Group B for BMI, however, no significant difference was found in other parameters.

2 Validity of the crossover method

The effects of either order or period for testing on the AUC from blood glucose levels were not statistically significant, $P=0.23$ and $P=0.74$ respectively. Thus, we conclude that carry-over effect can be ignored and the result obtained from the crossover design in the present study can be evaluated appropriately.

3 Evaluation of the validity

1) Blood glucose AUC and C_{max}

Blood glucose levels peaked at 30 min after ingesting the loading meal, then began to decrease (**Fig. 2A**). The blood glucose levels at 30 min were 159.9±2.0 mg/dL with the PHGG supplement and 164.7±2.1 mg/dL with the placebo supplement. The difference between the PHGG and placebo supplement was −4.8±1.5 mg/dL, which was significantly lower in PHGG supplement than the placebo supplement ($P=0.002$). The blood glucose levels at 60 min were 154.1±4.2 mg/dL with the PHGG supplement and 161.2±4.6 mg/dL with the placebo supplement. The difference between the PHGG and placebo supplement was −7.0±3.0 mg/dL, a significantly lower upon ingestion of the PHGG than placebo supplement ($P=0.024$).

Table 1 Background of the subjects

	Total	Group A	Group B	*P*-value
Number of subjects (male ; female)	56 (28 ; 28)	28 (13 ; 15)	28 (15 ; 13)	
Age	45.4±1.5	48.1±2.0	42.6±2.2	0.065
Height (cm)	164.41±1.03	164.00±1.46	164.82±1.49	0.70
Weight (kg)	62.54±1.63	59.44±2.05	65.64±2.42	0.056
BMI (kg/m^2)	23.07±0.50	22.00±0.55	24.14±0.78	0.030
Fasting blood glucose level (mg/dL)	99.5±1.0	99.9±1.4	99.1±1.5	0.69
Blood glucose level 30 min after loading diet ingestion (mg/dL)	167.2±1.5	165.1±2.0	169.2±2.1	0.17
AUC for blood glucose level (mg·h/dL)	296.1±4.6	296.4±7.0	295.8±6.2	0.95
C_{max} for blood glucose level (mg/dL)	180.6±2.6	180.0±4.2	181.1±3.2	0.85

Each value represents the mean±SEM.

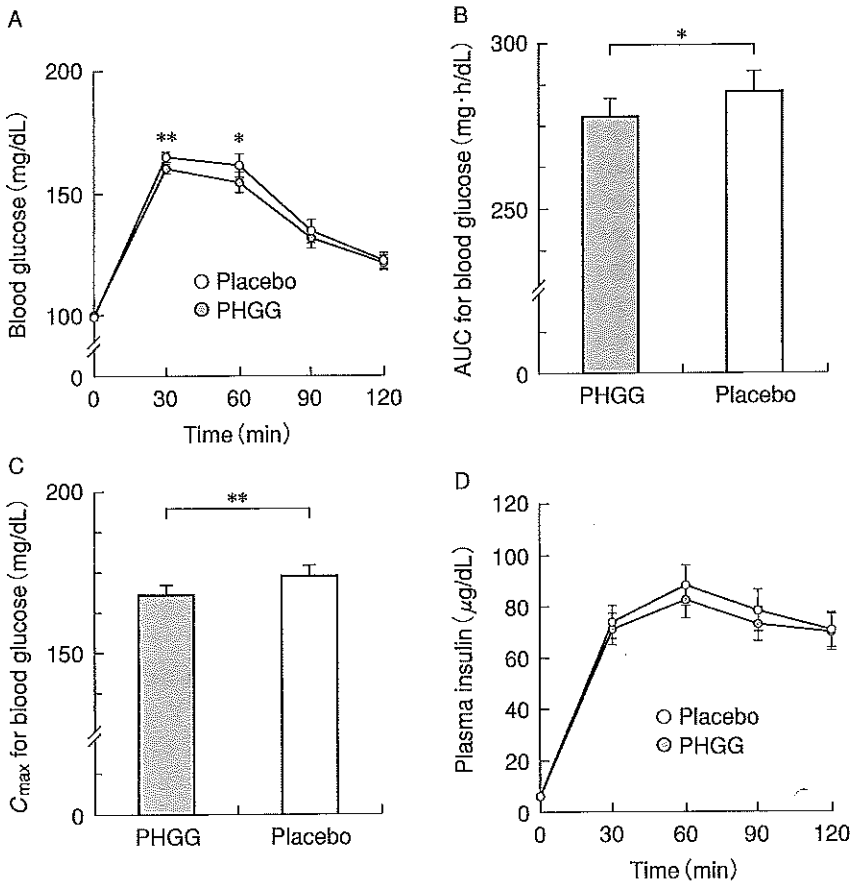

Fig. 2 Effect of the intake of PHGG on the level of postprandial blood glucose

(A) Change in the level of blood glucose. (B) AUC for blood glucose level. (C) C_{max} for blood glucose level. (D) Change in the level of plasma insulin.

Each value represents the mean±SEM of 56 subjects. $^{*}P<0.05$; $^{**}P<0.01$.

Postprandial blood glucose AUC, one of the primary endpoints, were 277.8±5.3 mg·h/dL with the PHGG supplement and 285.3±6.0 mg·h/dL with the placebo supplement. The difference between the PHGG supplement and placebo supplement was −7.5±3.6 mg·h/dL (**Fig. 2B**). Blood glucose C_{max} was 168.1±3.0 mg/dL with PHGG supplement and 174.1±3.3 mg/dL with the placebo supplement. The difference between the two treatments was −5.9±1.9 mg/dL (**Fig. 2C**). One-way ANOVA was significant in both blood glucose AUC ($P=0.043$) and blood glucose C_{max} ($P=0.004$). Therefore, we confirmed that the ingestion of the PHGG supplement

has a suppressive effect on the increased postprandial blood glucose level (**Fig. 2B, C**).

2) Blood insulin level

No significant difference between with PHGG and placebo supplement was found in either fasting or postprandial insulin levels (30, 60, 90, and 120 min after ingesting loading food) (**Fig. 2D**).

4 Adverse events

During the test period, total of 6 adverse events were observed in 5 subjects, however, all the symptoms were mild and not serious adverse events. In addition, all the adverse events were determined to be unrelated to the tested supplement by the principle investigator.

DISCUSSION

In the present study, we demonstrated that the ingestion of PHGG significantly decreased the levels of postprandial blood glucose AUC and blood glucose C_{max}, both of which are the primary endpoints. As for the postprandial blood glucose level, a secondary endpoint, significantly lower values were found with PHGG after 30 min and 60 min ingestion than with the placebo supplement. Although no significant difference was detected in the level of insulin between two supplements at either time point after the ingestion, it tended to be lower with food containing guar gum-degraded products than the placebo supplement. These results agree with the previously conducted test results using guar gum and guar gum-degraded products in both animals and humans,[6,7] confirming that the PHGG ingestion indeed suppresses the elevated level of postprandial blood glucose. The previous clinical study that we conducted was for an explorative and small-scale test that only aimed to confirm the minimum effective dose. Therefore, we did not strictly follow the guideline for subject selection, double blinding, crossover, etc.[6] Furthermore, a certain degree of error was expected as a conventional instrument for self-monitoring of blood glucose was used in the study.

In the present study, larger number of subjects were selected based on the inclusion and exclusion criteria, and the randomized, double-blind, placebo-controlled, crossover test was conducted. Since we confirmed that the order and date of testing did not affect the results from the crossover study, we became confident that the suppression of postprandial blood glucose levels that was observed was caused by PHGG ingestion itself.

Sugar from a meal is absorbed through the intestine, transferred into the blood stream, stored in the liver and muscles by insulin. The stored glucose is utilized in energy production. Type II diabetes patients exhibit insulin resistance and decreases in insulin secretion. Clinically, an elevation of postprandial blood glucose is observed before the onset of the disease. The combination of the fasting blood glucose level of 126 mg/dL or above and oral glucose tolerance level of 200 mg/dL or above after 2 hour is set to be one of the criteria for diagnosis of diabetes,[8] Until recently, the suppression of the fasting blood glucose level has been the main focus for treatment.[9] However, postprandial blood glucose was recently found to increase the risk of complications, such as retinopathy and cerebrovascular disease, more than fast blood glucose level.[10] Especially for pre-diabetic patients, such as patients with borderline-type or in the early stages of diabetes, it is important to control postprandial blood glucose levels, and food that suppresses the level is considered to be beneficial.

Moreover, ingestion of the PHGG food in the present study was not accompanied by any serious adverse events. Thus, the ingestion of PHGG with a meal is considered to be beneficial by preventing the onset of diabetes and improving one's lifestyle.

CONCLUSION

We examined the suppressive effects of a single-dose of PHGG on the elevation of postprandial blood glucose in adult males and females, who had a tendency for higher levels of postprandial blood glucose using a randomized, double blind, placebo-controlled, crossover protocol. We confirmed that PHGG ingestion indeed suppresses the elevation of postprandial blood glucose level.

【Conflicts of interest】 M. T., Z. Y., and M. O. are employees of Taiyo Kagaku Co. Ltd (TKC). TKC provided the research expenses to TTC Co., Ltd. J. S. received a research grant from TTC Co., Ltd, and have no conflicts of interest to declare. M. T., Z. Y., and M. O. were not involved in the interpretation of results, and not influenced the outcomes at any stage of the clinical trial.

REFERENCES

1) "National Health and Nutrition Survey", 2013, Ministry of Health, Labour, and Welfare.
2) Deguchi Y, Osada K, Uchida K, Kimura H, Yoshikawa M, Kudo T, et al. Effects of extract of guava leaves on the development of diabetes in the db/db mouse and on the postprandial blood glucose of human subjects. Nippon Nogeikagaku Kaishi 1998; 72: 923-31.
3) Wakabayashi S, Kishimoto Y, Nanbu S, Matsuoka A. Effect of Indigestible dextrin on postprandial rise in blood glucose lev-

els in man. (Fifth Report) J. Jpn. Assoc. Dietary Fiber Res 1999; 3, 13–9.
4) Fujita H, Yamagami T, Ohshima K. Fermented soybean-derived water-soluble Touchi extract inhibits alpha-glucosidase and is antiglycemic in rats and humans after single oral treatments. J Nutr 2001; 131: 1211–3.
5) Jenkins DJ, Wolever TM, Nineham R, Taylor R, Metz GL, Bacon S, et al. Guar crispbread in the diabetic diet. Br Med J 1978; 2: 1744–6.
6) Maenaka T, Yokawa T, Ishihara N, Gu Y, Juneja LR. Effects of partially hydrolyzed guar gum on postprandial blood glucose level and disaccharidase. J Jpn Soc Med Use Func Foods 2007; 4: 195–201.
7) Takahashi T, Yokawa T, Ishihawa N, Okubo T, Chu DC, Nishigaki E, et al. Hydrolyzed guar gum decreases postprandial blood glucose and glucose absorption in the rat small intestine. Nutrition Research 2009; 29: 419–25.
8) Evidence-based Practice Guideline for the Treatment for Diabetes in Japan, 2013, Nankodo.
9) Nathan DM, Buse JB, Davidson MB, Heine RJ, Holman RR, Sherwin R, et al. Management of hyperglycemia in type 2 diabetes: A consensus algorithm for the initiation and adjustment of therapy: a consensus statement from the American Diabetes Association and the European Association for the Study of Diabetes. Diabetes Care 2006; 29: 1963–72.
10) The DECODE study group on behalf of the European Diabetes Epidemiology Group. Glucose tolerance and mortality: comparison of WHO and American Diabetic Association diagnostic criteria. Lancet 1999; 354: 617–21.

Received 10 November 2015; Accepted 15 December 2015

* * *