



Original article

Effect of a tapioca fiber (FiberSMART®) on postprandial glycemic response: A randomized controlled feeding trial in healthy participants

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ABSTRACT

Background: Resistant dextrins are novel dietary fibers derived from natural starch sources that are not hydrolyzed by human digestive enzymes. FiberSMART® is a tapioca- or corn-based resistant dextrin used in a range of food beverages which has been reported to be well tolerated in previous studies. Its effects on plasma glucose responses have not been fully characterized.

Objective: This trial aimed to compare the postprandial glycemic response to 20 g tapioca resistant dextrin relative to water (negative control) and 20 g dextrose (positive control).

Methods: In a randomized, cross-over design, 15 healthy adults completed three test days. Following an overnight fast, they consumed either 250 g of water alone or with 20 g dextrose or 20 g tapioca resistant dextrin powder. Plasma glucose was measured twice before, and at 15, 30, 45, 60, 90 and 120 min postprandial. The primary endpoint was incremental area under the glucose curve (iAUC), with secondary endpoints including peak glucose and T_{max}.

Results: No significant differences in plasma glucose iAUC were observed between tapioca resistant dextrin (15.7 ± 1.7 mmol x min/L) and the water control (4.2 ± 1.3 mmol x min/L), whereas both produced significantly lower responses than the dextrose control (148.3 ± 10.9 mmol x min/L) ($p < 0.001$). There were no significant differences in glucose T_{max} between the tapioca resistant dextrin and dextrose control. The glycemic response to the tapioca resistant dextrin was markedly attenuated relative to the dextrose control, with a lower peak glucose concentration ($\Delta 3.15 \pm 0.10$ mmol/L, $p < 0.001$).

Conclusions: Tapioca-based resistant dextrin behaves as expected for a dietary fiber. Future trials should explore whether this resistant dextrin holds other cardiometabolic benefits of dietary fiber.

Registration: clinicaltrials.gov NCT07075822.

1. Introduction

Dietary fibers are complex carbohydrate structures that are resistant to enzymatic digestion. They encompass naturally occurring plant components and novel fibers that are synthetically produced or modified from natural sources [1]. The unique chemical composition of some fibers can lead to acute improved glycemic responses to carbohydrate-containing foods [2,3], as well as longer-term benefits on cholesterol [4–7], glycemic markers of diabetes [8] and body weight [9]. Collectively, these effects translate to reductions in cardiovascular disease risk [10], which are the leading non-communicable disease global health burdens [11,12]. While several population health initiatives have aimed at promoting a high fiber diet, including health claims [13], healthy

eating guidelines [14,15] and nutrient facts panels, population levels from dietary sources remain at half the recommended intakes [16].

Novel dietary fibers provide an option for supplementation or to be used as an ingredient to increase the dietary fiber contents of manufactured foods. FiberSMART® is a resistant dextrin derived from corn or tapioca, consisting of glucose polymers with a degree of polymerization of ~10.6 [17], processed to replace digestible glycosidic linkages with those resistant to human enzymatic cleavage. It has been shown to be well-tolerated with no significant GI symptoms even at daily intakes of 50 g [18]. It has a neutral to mild sweet flavour that is well-suited for a wide range of products including snack foods, baked goods, confectionary products, sauces and beverages. However, whether it elicits a glycemic response or attenuates the glycemic response to a carbohydrate

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load has yet to be determined. We conducted a randomized controlled trial to first characterize the glycemic response following consumption of tapioca resistant dextrin without a carbohydrate load, testing the hypothesis that its postprandial glucose response is not different than that from water and significantly lower than that from an equivalent total carbohydrate load from glucose.

2. Methods

2.1. Design

We conducted an open-label, randomized, controlled cross-over study at a contract research organization (INQUIS Clinical Research Ltd., Toronto, Ontario; INQUIS) to explore the glycemic response to a tapioca-based dietary fiber relative to a dextrose (positive control) and water (negative control) drink. The sequence of the three interventions was randomized using a random sequence generator. Participants were assigned to a sequence at their first test visit. The protocol was approved by the Western Institutional Review Board (protocol #971199) on 20 November 2024 and registered at clinicaltrials.gov (NCT07075822) on 10 July 2025. The protocol was registered after the start of participant enrolment but prior to the last study visit and data locking and analysis.

2.1.1. Participants

Healthy participants were recruited from the participant database at INQUIS which includes volunteers who have expressed interest in participating in clinical research and have provided permission to be recruited for future trials. A clinical research coordinator contacted potentially eligible participants by telephone to describe the trial. Those interested were invited to the clinic for a screening visit to have height and weight measured and complete a self-reported health questionnaire to determine eligibility. Participants were deemed eligible if they were 18–75 years old, in good health with no known history of diabetes or other major diseases, not pregnant or lactating and with no known intolerances to the test products. Individuals who were taking medications that influenced glucose metabolism or digestion and absorption of nutrients were excluded. All participants provided written informed consent prior to enrollment in the trial.

2.1.2. Test beverages

Each participant tested three isovolumetric beverages in a random order: 1) 20 g of tapioca based resistant dextrin powder dissolved into 250 g of water; 2) Dextrose (positive) control consisting of 21.9 g of hydrous dextrose (equivalent to 20 g of available carbohydrate) dissolved in 250 g of water and 3) 250 g of water (negative) control. In addition to the test beverage, participants were also provided with an additional 125 g of water to rinse out the mouth. The dose was selected based on being a representative example of a serving size of the fiber.

2.1.3. Procedures

Eligible participants were studied on 3 separate days over a period of 2–4 weeks with at least 2 calendar days between visits. On each test day, participants came to INQUIS after an overnight fast of minimum 10 h, consuming nothing other than water. Participants were asked to maintain stable dietary and activity habits throughout their participation in the study, and to avoid unusual levels of food intake, unusual or strenuous physical activity, smoking and alcohol consumption 24 h before each visit. If the participant had any signs or symptoms of an active infection within 5 days prior to the test visit, the visit was rescheduled until all signs and symptoms had resolved and any treatment (i.e., antibiotic therapy) had been completed for at least 5 days prior to the test visit. If the participant had not complied with the preceding experimental conditions, the test was cancelled and rescheduled for another day. After reviewing drug and medical history and confirming that the participant had complied with instructions regarding fasting, alcohol, food intake and physical activity for the day before, participants

were weighed, and 2 fasting finger prick blood samples at approximately 5 min intervals were collected. After the second blood sample, participants started to consume a test beverage and were asked to consume it in entirety within 12 to 15 min. A timer was started at the first sip of the test beverage and further finger prick blood samples were obtained at 15, 30, 45, 60, 90 and 120 min. Participants remained seated quietly and no other food or drink was consumed during the 2 h test period. After the last blood sample had been obtained, participants were offered a snack and permitted to leave.

2.2. Outcomes

The primary outcome measure was iAUC over 2 h for plasma glucose. Secondary outcome measures were peak, time to peak (T_{max}) and incremental change at each time point in plasma glucose.

2.2.1. Blood analyses

Blood collection tubes were labeled with the participant identification (ID) and visit date. Blood samples were collected via finger-prick. Participants placed 5–6 drops of capillary blood into one microtube containing heparin-fluoride at each collection time. Samples were immediately centrifuged, stored at 4 °C and analyzed within 5 days of collection using the VITROS 350 Chemistry System (Ortho Clinical Diagnostics, Raritan, NJ). The analytical coefficient of variation (CV) for plasma glucose is <2%.

2.3. Blinding

The treatment beverages were identical in appearance and were presented to the participants in the same manner. However, participants were not blinded to the treatments due to the different flavour profiles with the dextrose perceptibly sweet relative to the other treatments. The study statistician (ALJ) was blinded to treatment identity until all analyses were finalized.

2.4. Statistical analysis

Study participant characteristics are presented as mean $\pm$ SD and all other data are presented as mean $\pm$ SE. The iAUC was calculated using the trapezoid rule, ignoring area beneath the baseline [19]. For the iAUC calculation, fasting glucose was taken to be the mean of the first measurement of the glucose concentration at times –5 and 0 min. Data for iAUC, peak and T_{max} glucose were analyzed by one-factor repeated-measures analysis of variance using the general linear model (GLM), examining the main effect of treatment. Glucose concentrations at each time point were analyzed by two-factor repeated-measures ANOVA, with participants treated as a within-subject factor and examining the main effects of treatment and time and the treatment $\times$ time interaction. After demonstrating significant interaction, the differences between individual means were compared using Tukey's test to control for multiple comparisons, with the criterion for significance being two-tailed $p < 0.05$. All statistical analyses were completed using NCSS 10 Data Analysis 2015 by a statistician (ALJ) blinded to the treatment identity until all analyses were finalized.

A sample size of 15 participants was calculated to have 80% power to detect a 25% difference in iAUC with a 2-tailed alpha of 0.05 assuming a within individual iAUC coefficient of variation of 23% [20].

3. Results

The study visits were conducted from 11 June 2025 to 15 July 2025. Fifteen generally healthy individuals were enrolled and randomized in the trial. All fifteen participants (5M:10F; 42 ± 16 yr; BMI 26.8 ± 5.2 kg/m²) completed the study and were included in the final analysis. Table 1 presents the participant characteristics. The study intervention was well tolerated, with no adverse events observed.

Table 1
Participant baseline characteristics.^a

	ALL	M	F
N	15	5	10
Age (years)	41.6 ± 16.3	36.6 ± 14.9	44.1 ± 17.2
Height (cm)	164.9 ± 8.0	171.9 ± 9.4	161.4 ± 4.3
Weight (kg)	72.8 ± 13.3	75.3 ± 9.8	71.5 ± 15.0
BMI (kg/m ²)	26.8 ± 5.2	25.6 ± 4.1	27.5 ± 5.8
Fasting plasma glucose (mmol/L)	5.38 ± 0.3	5.43 ± 0.4	5.35 ± 0.3
Ethnicity (n)			
White	8	2	6
Asian	6	3	3
Latino	1	0	1

^a Values are presented as mean ± SD.

Fig. 1 illustrates the incremental blood glucose response to the three test meals. There were no differences in mean fasting blood glucose before each meal. There were no differences in the postprandial glucose response from tapioca resistant dextrin and water, except at 30 min where tapioca resistant dextrin elicited a modest but statistically significant increase relative to water (0.50 ± 0.09 mmol/L, $p = 0.001$). Blood glucose levels were higher at 15, 30, 45 and 60 min and lower at 120 min following dextrose versus tapioca resistant dextrin and water ($p < 0.01$ for each time point and test comparison).

Fig. 2 and Table 2 depict the iAUC for blood glucose following each test series. The blood glucose response elicited by tapioca resistant dextrin was not different than that from water ($\Delta 11.6 \pm 1.8$ mmol x min/L, $p = 0.39$ but significantly lower than that from dextrose ($\Delta 132.5 \pm 10.1$ mmol x min/L, $p < 0.001$). There were no significant differences in the time to achieve peak glucose following the test meals. The peak glucose following the tapioca resistant dextrin meal was significantly higher than that following water ($\Delta 0.37 \pm 0.11$ mmol/L, $p = 0.006$) and significantly lower than that following dextrose ($\Delta 3.15 \pm 0.10$ mmol/L, $p < 0.001$).

4. Discussion

We conducted a randomized controlled 2-h feeding trial in 15 healthy participants to characterize the postprandial glycemic profile of a single 20 g dose of FiberSMART®, a tapioca based resistant dextrin, compared to an isovolumetric water control and a total carbohydrate matched dextrose control. The postprandial glucose iAUC following tapioca resistant dextrin was not different than that following the water

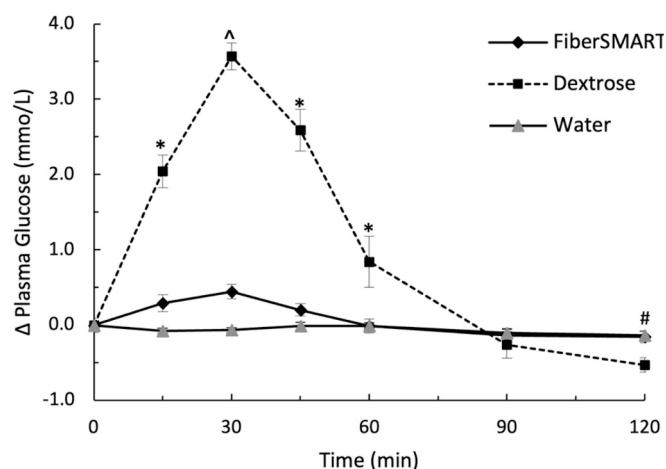


Fig. 1. Incremental postprandial glucose response to 20 g of FiberSMART®, 20 g of dextrose and water over 120 min. Data are expressed as mean ± SEM. * = Dextrose > Water and FiberSMART®; ^ = Dextrose > Water and FiberSMART®, FiberSMART® > Water; # = Dextrose < Water and FiberSMART®, all values $p < 0.05$.

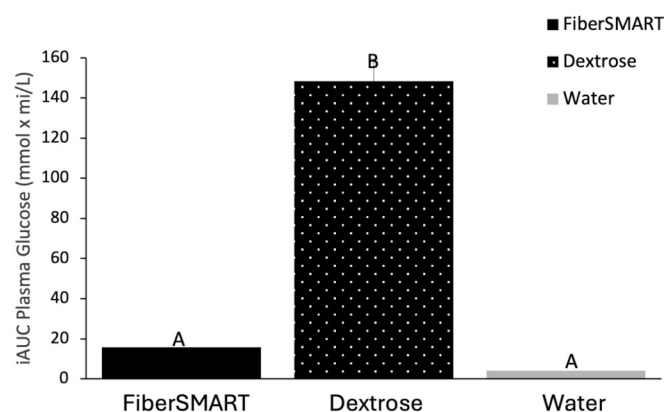


Fig. 2. Incremental areas under the curve after 20 g of FiberSMART®, 20 g dextrose control (Dextrose) and water control (Water), with the same 15 participants in each treatment. Values are expressed as Mean ± SEM. Bars with different letters are statistically significantly different ($p < 0.05$).

Table 2

Mean plasma glucose incremental area under the curve (iAUC), Tmax and peak height for each test beverage.

ENDPOINT	TEST SERIES		
	FiberSMART®	Dextrose	Water
Glucose iAUC (mmol x min/L)	15.7 ± 1.7 ^a	148.3 ± 10.9 ^b	4.2 ± 1.3 ^a
Glucose Peak Height (mmol/L)	5.9 ± 0.1 ^a	9.0 ± 0.2 ^b	5.5 ± 0.1 ^c
Glucose Tmax (min)*	24 ± 2	30 ± 1	–

Values are Mean ± SEM in $n = 15$ participants.

^{abc}Values with a different letter are statistically significantly different within each row, $p < 0.01$.

* Glucose Tmax is an exploratory measure to characterize the blood glucose curve. It is not a suitable endpoint in the absence of a carbohydrate load, as in the case of water where any changes in blood glucose reflect the minute-to-minute and analytical variation in the measure.

control and was significantly lower than following the dextrose control. Plasma glucose concentrations following FiberSMART® were significantly lower than those following dextrose at each time point, and were comparable to those following water, with the exception of 30 min, at which point FiberSMART® was significantly higher than water.

The modest rise in plasma glucose at 30 min relative to the water control indicates that some of the tapioca based resistant dextrin is digestible. Since the incremental glycemic response is linearly related to the available carbohydrate dose over 0 to 20 g, the glycemic impact of a low-carbohydrate serving can be expressed as an equivalent glycemic load (EGL) [21]. EGL is defined as the weight of glucose eliciting the same incremental glycemic response. EGL of FiberSMART® is calculated as (iAUC blood glucose FiberSMART / iAUC blood glucose dextrose) x 20 g. A 20 g serving of FiberSMART yielded an EGL of 2 g, indicating that approximately 90% of the product is non-digestible carbohydrate. The EGL estimate is consistent with the analytically determined total dietary fiber content of 87% [17].

The findings of this clinical trial demonstrate that consumption of tapioca-based resistant dextrin does not result in significant or clinically meaningful increases in postprandial blood glucose, substantiating its functional similarity to dietary fibers. A comparable randomized controlled feeding trial conducted by our group in 2016 showed a similar postprandial glucose profile with a 20 g dose corn-based version of FiberSMART® relative to a 20 g dextrose control (iAUC blood glucose was 11.2 ± 1.8 mmol x min/L and 119.0 ± 11.9 mmol x min/L for corn-based fiber and dextrose, respectively, $p < 0.05$). This study also incorporated palatability testing which found the product to be highly palatable. Given the similar physicochemical properties of the tapioca-based (derived from cassava root) and corn-based versions [17], the

favourable palatability findings are reasonably expected from both products.

FiberSMART® is a well-tolerated resistant dextrin. No adverse events were reported in the current trial or in the earlier corn-based trial. Additionally, a randomized controlled two-arm parallel trial in 38 healthy adults demonstrated that tapioca-based FiberSMART® doses of 10, 30 or 50 g per day for 7-days were well tolerated, with no significant GI symptoms reported relative to a placebo [18]. In line with tapioca resistant dextrin, other clinical trials have observed that resistant dextrin does not elicit GI symptoms acutely or long-term in varying populations including those that are generally healthy [22] and living with type 2 diabetes [23].

Resistant dextrin may have long-term benefits as an effective prebiotic, regulating the gut microflora by supporting growth of beneficial bacteria [24]. Characteristic of dietary fibers, resistant dextrin is non-digestible by human enzymes and passes through the small intestine intact. In the large intestine, the gut bacteria ferment the fibers to produce short chain free fatty acids (SCFA) that cross the mucosal membrane and enter systemic circulation. Elevated levels of SCFA have been attributed to the mechanisms leading to improvements in insulin sensitivity [25], satiety [26] and inflammation [27] associated with high fiber diets. Given the emergence of appetite-regulating medications, public interest has increased in mediators of appetite hormone regulators to which SCFAs can play a role. SCFAs bind to receptors to enteroendocrine L-cells in the intestinal mucosa, stimulating the secretion of GLP-1. While animal models have supported the hypothesis that resistant dextrin increases GLP-1 production [28–30], clinical trials have mixed results on whether resistant dextrins are beneficial [31] or not [32] on appetite regulation. Further research is needed to investigate long-term intakes and determine the dose thresholds, formulations and mode of administration that can optimize these potential benefits.

The findings of this trial should be interpreted in the context of its strengths and limitations. The randomized, cross-over design mitigates key sources of bias. The use of both positive and negative controls enhances internal validity, demonstrating that postprandial glycemic response from FiberSMART® was as expected relative to both comparators. Relative responses are also largely unaffected by diabetes status [3], sex [20] or age [33], supporting the extrapolation of these findings to other populations. Investigating a relative response rather than an absolute response allows applicability of the findings to different populations. The study also had some limitations that warrant consideration. To align with funding availability, we did not explore a dose-relationship or determine the proportional insulin response. Whether FiberSMART® attenuates the glycemic response to a carbohydrate load was not assessed and should be within the scope of subsequent trials. The acute feeding design also limits its generalizability to longer-term intakes.

5. Conclusion

This randomized controlled feeding trial confirms that tapioca-based FiberSMART® elicits a glycemic response characteristic of dietary fiber. The postprandial glucose response following a 20 g dose of tapioca resistant dextrin was similar to that following an isovolumetric water control and significantly lower than that following a carbohydrate matched dextrose control. These findings parallel those of our earlier feeding study on corn-based FiberSMART®. Future studies should determine a dose-response relationship and insulin response and explore whether FiberSMART® holds other cardiometabolic benefits associated with dietary fiber including lowering the glycemic response to a carbohydrate load.

CRediT authorship contribution statement

Andreea Zurbau: Writing – original draft, Visualization. **Steve Prancevic:** Writing – review & editing, Funding acquisition,

Conceptualization. **Alexandra L. Jenkins:** Writing – review & editing, Visualization, Supervision, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization.

Ethics statement

The study was conducted in accordance with the principles of the Declaration of Helsinki and the International Conference on Harmonization Good Clinical Practice guidelines. The protocol was approved by the Western Institutional Review Board (protocol #971199) on 20 November 2024 and registered at clinicaltrials.gov (NCT07075822) on 10 July 2025. All participants provided written informed consent prior to enrollment in the trial.

Author contributions

ALJ designed the study, supervised the trial and conducted the analyses. AZ drafted the manuscript. All authors provided edits to the manuscript and approved the final version, but the final content was determined by ALJ and AZ.

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This study was supported by Anderson Advanced Ingredients. The funder was not involved in the collection, analysis or interpretation of the data. SP reviewed the manuscript, but the final content was determined by ALJ and AZ.

Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: AZ and ALJ are employed by INQUIS Clinical Research, Ltd, a contract research organization. SP is employed by Anderson Advanced Ingredients, a supplier of specialty food ingredients including resistant dextrin, allulose, and natural sweeteners.

Data availability

Data on the tapioca-based fiber feeding trial presented in the manuscript will be made available upon reasonable request.

References

- [1] U.S. Food and Drug Administration, Questions and Answers on Dietary Fiber, U.S. Food and Drug Administration, 2024. Retrieved November 12 from, https://www.fda.gov/food/nutrition-food-labeling-and-critical-foods/questions-and-answers-dietary-fiber#define_dietary_fiber.
- [2] J.W. Anderson, P. Baird, R.H. Davis Jr., S. Ferreri, M. Knudtson, A. Koraym, V. Waters, C.L. Williams, Health benefits of dietary fiber, *Nutr. Rev.* 67 (4) (2009) 188–205, <https://doi.org/10.1111/j.1753-4887.2009.00189.x>.
- [3] A. Zurbau, J.C. Noronha, T.A. Khan, J.L. Sievenpiper, T.M.S. Wolever, The effect of oat β -glucan on postprandial blood glucose and insulin responses: a systematic review and meta-analysis, *Eur. J. Clin. Nutr.* 75 (11) (2021) 1540–1554, <https://doi.org/10.1038/s41430-021-00875-9>.
- [4] H.V. Ho, J.L. Sievenpiper, A. Zurbau, S. Blanco Mejia, E. Jovanovski, F. Au-Yeung, A.L. Jenkins, V. Vuksan, A systematic review and meta-analysis of randomized controlled trials of the effect of barley β -glucan on LDL-C, non-HDL-C and apoB for cardiovascular disease risk reduction (i-iv), *Eur. J. Clin. Nutr.* 70 (11) (2016) 1239–1245, <https://doi.org/10.1038/ejcn.2016.89>.
- [5] H.V.T. Ho, E. Jovanovski, A. Zurbau, S. Blanco Mejia, J.L. Sievenpiper, F. Au-Yeung, A.L. Jenkins, L. Duvnjak, L. Leiter, V. Vuksan, A systematic review and meta-analysis of randomized controlled trials of the effect of konjac glucomannan, a viscous soluble fiber, on LDL cholesterol and the new lipid targets non-HDL cholesterol and apolipoprotein B, *Am. J. Clin. Nutr.* 105 (5) (2017) 1239–1247, <https://doi.org/10.3945/ajcn.116.142158>.
- [6] E. Jovanovski, S. Yashpal, A. Komishon, A. Zurbau, S. Blanco Mejia, H.V.T. Ho, D. Li, J. Sievenpiper, L. Duvnjak, V. Vuksan, Effect of psyllium (*Plantago ovata*) fiber on LDL cholesterol and alternative lipid targets, non-HDL cholesterol and apolipoprotein B: a systematic review and meta-analysis of randomized controlled trials, *Am. J. Clin. Nutr.* 108 (5) (2018) 922–932, <https://doi.org/10.1093/ajcn/nqy115>.

- [7] A. Whitehead, E.J. Beck, S. Tosh, T.M. Wolever, Cholesterol-lowering effects of oat β -glucan: a meta-analysis of randomized controlled trials, *Am. J. Clin. Nutr.* 100 (6) (2014) 1413–1421, <https://doi.org/10.3945/ajcn.114.086108>.
- [8] E. Jovanovski, R. Khayyat, A. Zurbau, A. Komishon, N. Mazhar, J.L. Sievenpiper, S. Blanco Mejia, H.V.T. Ho, D. Li, A.L. Jenkins, L. Duvnjak, V. Vuksan, Should viscous fiber supplements be considered in diabetes control? Results from a systematic review and meta-analysis of randomized controlled trials, *Diabetes Care* 42 (5) (2019) 755–766, <https://doi.org/10.2337/dc18-1126>.
- [9] E. Jovanovski, N. Mazhar, A. Komishon, R. Khayyat, D. Li, S. Blanco Mejia, T. Khan, A.L. Jenkins, L. Smircic-Duvnjak, J.L. Sievenpiper, V. Vuksan, Effect of viscous fiber supplementation on obesity indicators in individuals consuming calorie-restricted diets: a systematic review and meta-analysis of randomized controlled trials, *Eur. J. Nutr.* 60 (1) (2021) 101–112, <https://doi.org/10.1007/s00394-020-02224-1>.
- [10] D.E. Threapleton, D.C. Greenwood, C.E. Evans, C.L. Cleghorn, C. Nykjaer, C. Woodhead, J.E. Cade, C.P. Gale, V.J. Burley, Dietary fibre intake and risk of cardiovascular disease: systematic review and meta-analysis, *Bmj* 347 (2013) f6879, <https://doi.org/10.1136/bmj.f6879>.
- [11] A.J. Ferrari, D.F. Santomauro, A. Aali, Y.H. Abate, C. Abbafati, H. Abbastabar, S. Abd ElHafeez, M. Abdelmasseh, S. Abd-El Salam, A. Abdollahi, A. Abdullahi, K. H. Abegaz, R.A. Abeldano Zúñiga, R.G. Aboagye, H. Abolhassani, L.G. Abreu, H. Abualruz, E. Abu-Gharbieh, N.M.E. Abu-Rmeileh, C.J.L. Murray, Global incidence, prevalence, years lived with disability (YLDs), disability-adjusted life-years (DALYs), and healthy life expectancy (HALE) for 371 diseases and injuries in 204 countries and territories and 811 subnational locations, 1990–2021: a systematic analysis for the Global Burden of Disease Study 2021, *Lancet* 403 (10440) (2024) 2133–2161, [https://doi.org/10.1016/S0140-6736\(24\)00757-8](https://doi.org/10.1016/S0140-6736(24)00757-8).
- [12] Institute for Health Metrics Evaluation, Global Burden of Disease 2021: Findings from the GBD 2021 Study, 2024.
- [13] R. Mathews, A. Kamil, Y. Chu, Global review of heart health claims for oat beta-glucan products, *Nutr. Rev.* 78 (Suppl. 1) (2020) 78–97, <https://doi.org/10.1093/nutrit/nuz069>.
- [14] Health Canada, Canada's Food Guide, Government of Canada, 2026. Retrieved September 24, 2026 from, <https://www.canada.ca/en/health-canada/services/food-guide.html>.
- [15] U.S. Department of Agriculture, MyPlate, U.S. Department of Agriculture, 2026. Retrieved September 24, 2026 from, <https://cdn.realfood.gov/DGA.pdf>.
- [16] M.K. Hoy, J.D. Goldman, Fiber intake of the U.S. population: what we eat in America, NHANES 2009–2010, in: *FSRG Dietary Data Briefs, United States Department of Agriculture (USDA)*, 2010.
- [17] U.S. Food and Drug Administration, GRAS Notice 1045: Resistant Dextrin from Tapioca (FiberSMART®-Tapioca), U.S. Food and Drug Administration, 2021. Retrieved November 11, 2025 from, <https://www.fda.gov/media/161882/download>.
- [18] S. Teo, T. Fairchild, Evaluation of the gastrointestinal tolerability of Fibersmart®, a novel dietary fiber, using a randomized controlled trial in healthy men and women, *ECronicon* 16 (12) (2021).
- [19] T.M. Wolever, Effect of blood sampling schedule and method of calculating the area under the curve on validity and precision of glycaemic index values, *Br. J. Nutr.* 91 (2) (2004) 295–301, <https://doi.org/10.1079/bjn20031054>.
- [20] T.M. Wolever, J.C. Brand-Miller, J. Abernethy, A. Astrup, F. Atkinson, M. Axelsen, I. Björck, F. Brighenti, R. Brown, A. Brynes, M.C. Casiraghi, M. Cazaubiel, L. Dahlqvist, E. Delpont, G.S. Denyer, D. Erba, G. Frost, Y. Granfeldt, S. Hampton, J. Zhang, Measuring the glycemic index of foods: interlaboratory study, *Am. J. Clin. Nutr.* 87 (1) (2008) 247s–257s, <https://doi.org/10.1093/ajcn/87.1.247s>.
- [21] T.M. Wolever, A.L. Gibbs, M. Spolar, E.V. Hitchner, C. Heimowitz, Equivalent glycemic load (EGL): a method for quantifying the glycemic responses elicited by low carbohydrate foods, *Nutr. Metab. (Lond.)* 3 (2006) 33, <https://doi.org/10.1186/1743-7075-3-33>.
- [22] I.P. van Munster, H.M. de Boer, M.C. Jansen, A.F. de Haan, M.B. Katan, J.M. van Amelsvoort, F.M. Nagengast, Effect of resistant starch on breath-hydrogen and methane excretion in healthy volunteers, *Am. J. Clin. Nutr.* 59 (3) (1994) 626–630, <https://doi.org/10.1093/ajcn/59.3.626>.
- [23] A. Aliasgharzadeh, P. Dehghan, B.P. Gargari, M. Asghari-Jafarabadi, Resistant dextrin, as a prebiotic, improves insulin resistance and inflammation in women with type 2 diabetes: a randomised controlled clinical trial, *Br. J. Nutr.* 113 (2) (2015) 321–330, <https://doi.org/10.1017/s0007114514003675>.
- [24] M. Włodarczyk, K. Śliżewska, Efficiency of resistant starch and dextrins as prebiotics: a review of the existing evidence and clinical trials, *Nutrients* 13 (11) (2021), <https://doi.org/10.3390/nu13113808>.
- [25] N.H.T. Pham, M.V. Joglekar, W.K.M. Wong, N.T. Nassif, A.M. Simpson, A. A. Hardikar, Short-chain fatty acids and insulin sensitivity: a systematic review and meta-analysis, *Nutr. Rev.* 82 (2) (2023) 193–209, <https://doi.org/10.1093/nutrit/nuad042>.
- [26] H. Han, B. Yi, R. Zhong, M. Wang, S. Zhang, J. Ma, Y. Yin, J. Yin, L. Chen, H. Zhang, From gut microbiota to host appetite: gut microbiota-derived metabolites as key regulators, *Microbiome* 9 (1) (2021) 162, <https://doi.org/10.1186/s40168-021-01093-y>.
- [27] S. Sivaprakasam, P.D. Prasad, N. Singh, Benefits of short-chain fatty acids and their receptors in inflammation and carcinogenesis, *Pharmacol. Ther.* 164 (2016) 144–151, <https://doi.org/10.1016/j.pharmthera.2016.04.007>.
- [28] M.J. Keenan, J. Zhou, K.L. McCutcheon, A.M. Raggio, H.G. Bateman, E. Todd, C. K. Jones, R.T. Tulley, S. Melton, R.J. Martin, M. Hegsted, Effects of resistant starch, a non-digestible fermentable fiber, on reducing body fat, *Obesity (Silver Spring)* 14 (9) (2006) 1523–1534, <https://doi.org/10.1038/oby.2006.176>.
- [29] J. Zhou, R.J. Martin, A.M. Raggio, L. Shen, K. McCutcheon, M.J. Keenan, The importance of GLP-1 and PYY in resistant starch's effect on body fat in mice, *Mol. Nutr. Food Res.* 59 (5) (2015) 1000–1003, <https://doi.org/10.1002/mnfr.201400904>.
- [30] J. Zhou, R.J. Martin, R.T. Tulley, A.M. Raggio, K.L. McCutcheon, L. Shen, S. C. Danna, S. Tripathy, M. Hegsted, M.J. Keenan, Dietary resistant starch upregulates total GLP-1 and PYY in a sustained day-long manner through fermentation in rodents, *Am. J. Physiol. Endocrinol. Metab.* 295 (5) (2008) E1160–E1166, <https://doi.org/10.1152/ajpendo.90637.2008>.
- [31] Z. Ye, V. Arumugam, E. Haugabrooks, P. Williamson, S. Hendrich, Soluble dietary fiber (Fibersol-2) decreased hunger and increased satiety hormones in humans when ingested with a meal, *Nutr. Res.* 35 (5) (2015) 393–400, <https://doi.org/10.1016/j.nutres.2015.03.004>.
- [32] C.H. Emilien, W.H. Hsu, J.H. Hollis, The effect of soluble fiber dextrin on subjective and physiological markers of appetite: a randomized trial, *Nutrients* 12 (11) (2020), <https://doi.org/10.3390/nu12113341>.
- [33] T.M. Wolever, A. Zurbau, Are there age-related differences in glycaemic response and glycaemic index? *Eur. J. Clin. Nutr.* 80 (8) (2026) 741–746, <https://doi.org/10.1038/s41430-026-01773-8>.