International Journal of Biological and Pharmaceutical Sciences Archive

ISSN: 0799-6616 (Online)

Journal homepage: https://ijbpsa.com/

(REVIEW ARTICLE)

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Empirical facts about Erythritol's effects on whole body systems: A systematic Review

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International Journal of Biological and Pharmaceutical Sciences Archive, 2023, 06(01), 039–048

Publication history: Received on 21 March 2023; revised on 09 May 2023; accepted on 11 May 2023

Article DOI: https://doi.org/10.53771/ijbpsa.2023.6.1.0037

Abstract

Background: There is an important public health message concerning obesity, diabetes, and the reduction of sugar consumption. Erythritol seems like the sweetener of choice but contrasting evidence exists so there is therefore a pertinent need to establish rigorous facts to ensure Erythritol 'dosage' is correct and to improve the nation's health.

Objectives: To plot the landscape by assessing all robust research to discover 'safe erythritol use', 'acceptable' side effects, and most importantly the whole 'body systems' impact and interactions. Also, to establish whether 25g/day could be safely doubled, maximum laxative thresholds, and unique Erythritol characteristics.

Methods: All knowledge type/outcomes and grey data were eligible and reported according to 'body system's using EQUATOR and PRISMA guidelines. Bias was kept to a minimum via BEME rigor checklists.

Results: 256 papers were included in the review. 'Safe use' Erythritol amounts and maximum thresholds were established. No disadvantages of Erythritol were found providing thresholds were not exceeded. Erythritol has unique properties which produced important new findings: Erythritol is metabolised differently for 'Diabetic versus non-diabetic', and 'Early-stage versus late-stage diabetic'; In the 'obese versus lean'; and if taken within 'Solids versus liquids'.

Conclusions: New knowledge on safe Erythritol 'dosage', maximally effective period, and body systems were gained which affect and inform the nation's weight and health choices.

Keywords: Systematic review; Erythritol metabolism; Body systems; Erythritol safety

1 Introduction

For some time, there has been an important public health message concerning obesity, diabetes, and sugar consumption. The UK's mean sugar intake is three times higher than the maximum recommended level of 5% for school-aged children, and twice the recommended level for adults (1). The IDF (2) believe 50%> of the global population are undiagnosed diabetics which poses a 'socioeconomic threat'. The World Health Organization (3) consequently tasked the UK to lead global action to reduce sugar intake and Erythritol became an 'up-and-coming sweetener'. It seems a solid choice for all, however a large amount of anecdotal and dichotomous evidence exists, especially concerning weight management and blood pressure. There is therefore a pertinent need for a review to establish what the rigorous facts are, what impacts Erythritol has on whole body systems, and whether Erythritol can truly replace sugar and fulfil dietary needs.

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This review is the first of its kind as some Erythritol properties are known but detailed information about 'whole body actions and interactions' with their ensuing related processes does not currently exist. This review therefore maps Erythritol actions within whole body systems to better understand what happens once Erythritol is consumed - thereby helping to correctly identify consumption parameters and to act accordingly. This review therefore draws disparate and 'siloed' body system information together so that any future Erythritol use can be tailored to individuals without compromising other body systems.

Aims: The primary objectives for this review were to: 'Discover/establish through mapping whole body system impacts what the 'safe' levels of erythritol are (i.e., maximum daily consumption)'; 'Identify whether 'acceptable' side effects/contraindications exist, and if so what these are'; and 'What impacts Erythritol (versus sugar) has on each body systems and obesity'. Secondary aims were to: 'Answer whether the 'safe' amount of 25g could be doubled without too many side effects'; 'Discover the maximum threshold for any laxative effects'; and 'Whether the body actions of Erythritol are similar to other polyols'. These formed the research questions.

2 Material and methods

2.1 Eligibility criteria

Criteria was wide to capture all available data. Inclusion encompassed 'any full text study paper in English containing the term Erythritol'. Data type was not limited, so any completed/evaluated item from any discipline was eligible providing it addressed an identifiable topic/outcome/standard attainment and was not too ambiguous for a rigor judgment. No population age criteria was specified so that all ages could be evaluated. All genders, cultures, ethnic backgrounds, and nationalities were eligible.

2.2 Information sources

All information was searched for between April and September 2022. Databases were the primary sources, followed by grey literature, then hand-searching. Any paper referring to Erythritol was followed up, and full text papers sought. Data was grouped according to body systems for ease of reading. To maintain standardised rigor 'Best Evidence in Medical Education' rigor sheets were used to screen papers (4). Results synthesis followed EQUATOR and PRISMA reporting guidelines (5).

2.3 Search strategy

MEDLINE, CINAHL, AMED, BNI, Cochrane studies, EMCARE, Intermid, Maternity and Infant care, Nursing and allied health, PubMed, and PubPsych data sources were used via Ovid, and EBSCOhost platforms. To double check for missed papers, search engines and websites were used (e.g., Google Scholar, Journal finder, RCN Library catalogue, and ResearchGate).

2.4 Terms searched ~~were~~

E968, Erythritol, Non-nutritive sweeteners, Benefits of erythritol, Negative effects of erythritol, Bulk-forming sweeteners, artificial sweeteners, Pain relief sweeteners, polyols, non-caloric sweetener, sugar alcohols, non-sugar sweeteners, modified sugars, Natural calorific/non-caloric sweeteners, low-calorie bulk sweeteners, erythritol AND sucrose OR glucose OR sugar solution OR oral sweet solution.

2.5 Selection criteria/data extraction process

Primary/secondary aim questions were added to EQUATOR/PRISMA questions to extricate new knowledge. During screening all items mentioning Erythritol were presented for data extraction. Items were marked 'DONE' if the study fulfilled all stated categories; 'NOT CLEAR' if insufficient details were given making data categorisation difficult; or 'NOT DONE' if required information was unreported/unobtainable. Outcome measures included taste, health, obesity effects, body system/organ function, treatment costs, immunity/infection level, comparisons to sugar/other polyols, and benefits versus negatives. No assumptions were made regarding missing data, but author clarification was sought where possible to achieve the richest possible data.

2.6 Sampling, study/participant characteristics

These included participant numbers, age, gender, sample types, and duration/frequency of exposure to erythritol interventions. On the data extraction sheet studies needed to obtain most ticks in the 'Yes' column to be included. If most ticks were 'Don't know', the weight of evidence was considered before progressing. If most ticks were 'No', studies

were excluded. This fed into an 'evaluation method' judgement (i.e. implementation/appropriateness of design and data analysis) which ranged from 'very poor' to 'excellent.' A judgement on the overall 'Strength of findings,' ranged from 1 ('No clear conclusions') through to 5 ('Unequivocal results').

2.7 Rigor

Once data extraction was complete, all papers/studies achieving a majority of 'yes' ticks were evaluated via BEME's 'Methodological Rigor sheets'. Each paper needed to fulfil the majority of rigor points (blinding, etc.) to progress. If most fell into the 'hard to tell' category papers were included with caveats to aid transparency, but excluded if most rigor points fell within the 'no' column. This resolved the majority of inconsistencies. The review protocol was written in March 2022, papers were searched for between April and September 2022, and the review undertaken during October 2022.

3 Results

Study selection: Search strategy and data selection appeared thorough with no areas of bias highlighted. Rigor was obvious except where reporting detail was poor. Quality therefore appeared good. A total of 5034 papers were identified for possible inclusion (see Figure 1):

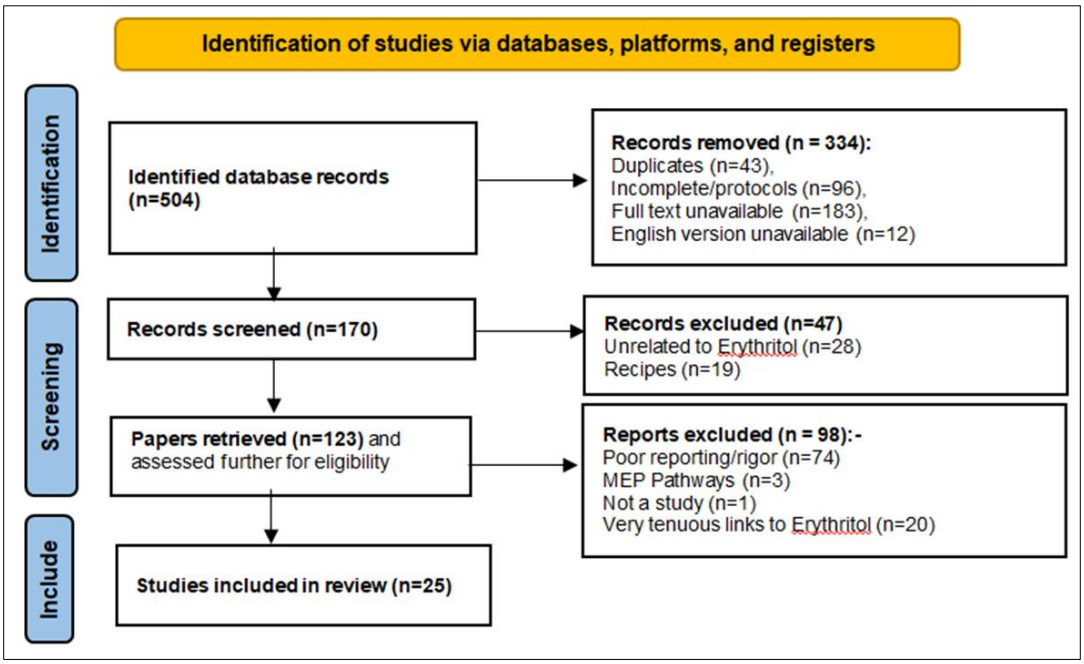

Figure 1 Study selection

Included studies were: Azad et al 2017 (6), Toews 2019 (7), Overduin et al 2016 (8), Chukwuma et al 2018 (9), Wee et al 2018 (10), Pham et al 2019 (11), Bordier et al 2021 (12) -Bordier et al 2022 was not included but will be discussed (13), Teysseire et al 2022 (14) and 2022 (15), Storey et al 2007 (16), Xiao-Hui et al 2022 (17), Oliveira et al 2022 (18), Wölnerhanssen et al 2021 (19), Jacqz-Aigrain et al 2015 (20), Stein et al 2021 (21), Plaza-Diaz et al 2020 (22), Hagi et al 2015 (23), Boesten et al 2015 (24), Hoshiko et al 2021 (25), Butera et al 2022 (26), Livesey 2003 (27), Arrigoni et al 2005 (28), Mäkinen et al 2005 (29), and Meyer-Gerspach et al 2022 (30).

3.1 Study types

There were 9 reviews (1 with meta-analysis, 2 citing evidence with data, 2 evidence with meta-analysis, 1 descriptive, 1 conceptual, and 2 literature reviews); 7 randomised trials (including 4 cross-sectional, 1 case-controlled); 4 comparative cross-sectional studies/multiple group interrupted time series; 3 single group series/'before-and-after' contemporaneous CBA studies, and 2 observational studies (1 case-controlled, 1 Non-comparative).

3.2 Outcomes

These included 'More benefits' or 'less disadvantages' of consuming Erythritol than sugar (35), Better health (13), Less obesity (8), Better body system function (6), Safer (4), Better organ function (3), Reduced treatment costs (3), Better taste (2), and Less infection (2). These appear overwhelmingly positive however contrasting weight evidence exists so this should be explained (see 'Discussion' section).

3.3 Sampling/participant characteristics

Participants numbers ranged from 12-755 (Mean=119). Ages ranged from 4-70 years (mean=32). Gender generally relied on statistical/methodological techniques to assume heterogeneity. Most unstated sample types were convenience samples. Study locations included Europe, Northern America, India, and China. Erythritol exposure duration varied considerably (<10 hours to 38 years). Frequency ranged from 1-10+ times. 15 studies achieved 'good' or 'excellent' on the 'Evaluation methods' judgement, 7 were 'okay'. 'Strength of findings' judgement for most studies were either 'Results are clear and very likely to be true' or 'Outcomes can probably be based on the results'. Only 3 studies scored '1' ('No clear conclusions') and were therefore excluded from analysis.

3.4 Power

Calculations for some studies were unstated, but 7 used enough statistical analysis/standardised methods to be sure of their results.

3.5 Study bias risk

All outcome assessments were completed according to Cochrane's bias risk tools, and recommendations (31, 32). E.g. Table 1:

Table 1 Bias risk (RCTs)

Author	Random selection	Concealed allocation	Participant Blinding	Personnel Blinding	Incomplete outcome data	Selective reporting	Other bias
Bordier et al 2021	+	+	+	+	?	+	?*
Meyer-Gerspach et al 2022	+	+	+	+	?	+	+
Teysseire et al 2022	+	+	+	+	?	+	+
Teysseire et al 2022b	+	+	+	+	?	+	+
Storey et al 2007	+	+	+	+	+	+	+
Xiao-Hui et al 2022	+	+	+	-	+	?	?
Wölnerhanssen et al 2021	+	+	+	+	+	+	+

+ Low bias risk; - High bias risk; ? Unclear risk ; * Sample unrepresentative

3.6 Results syntheses

4 studies fulfilled all BEME (4) rigor criteria outright, 21 fulfilled it to varying degrees. 7 studies provided type IV evidence, 7 type III, 9 type II, and 2 type I. Research disciplines included: Nursing (n=1), Medicine, Dentistry, Health, and Nutrition which reveals a dearth of specific Erythritol Nursing research. Study environments included labs and real environments. Data types included Mice/Rats, Teeth/plaque, fermentation, Literature, and Patient outcomes. 24 studies stated 'Objective measurement/Interpretable data', 11 studies took the literature as their theoretical basis and 1 chose Lebet's fermentation method. 50% of new knowledge contained 'Patient management/safety/investigation', 'Health

outcomes/promotion/ professionals' role', and 'Practical procedure' aspects. The remaining 50% fell within 'Understanding basic/clinical sciences', perhaps demonstrating Erythritol's actions on the body are still poorly understood.

4 Discussion

4.1 Comments on Primary Objectives

- Safe Erythritol use

8 studies described maximum daily consumption as 7-36g per day. Consensus was 0.66g/kg bodyweight in male adults and children over 4, and 0.8g/kg for female adults (33, 34). Interestingly Bordier et al (12, 13) found that erythritol metabolization (into erythronate) was dose-dependent, i.e., absorption may be slower with 50g+ doses.

- Acceptable side effects

8 studies believed some side-effects were acceptable, describing unacceptable daily thresholds as 20g for children, and 25-30g for adults (laxation). 3 studies reported that 50-75g was 'well tolerated' (providing the person was 11> stone). 1 study (17) suggested ischaemic effects but gave 75g to rats weighing 100g (equating to 45kg for humans weighing 60kg). As such consumption is unrealistic this ischaemic finding was excluded.

- Body system/obesity impacts

33% of studies predicted 'sugar versus Erythritol' impact. No disadvantages were found providing aforementioned safe amounts were observed. When consumed within food, sugar and Xylitol produced more frequent/watery stools than Erythritol at identical amounts. However, if consumed in one drink this changed (16). Erythritol benefits included reduced calories; Healthier gut flora/muscle absorption; Delayed gastric emptying; and Short-acting gut hormone release (CCK/GLP-1/PYY stay high with glucose but not with Erythritol resulting in better blood glucose levels).

Findings were plotted visually to understand what body system pathways exist and spot emerging themes. The digestive system was the most popular system reported, followed by endocrine, circulatory, muscular/skeletal (Dental), Urinary, integumentary/skin and nervous/brain. Some papers covered more than one body system, and 11 studies covered obesity. Common themes were:

- Dental: Less biofilm/fibroblasts after 'air-polishing' (preventing periodontitis); Improved clinical outcomes after 6 months; and Anti-bacterial effects (23).
- Gastrointestinal (GI), Endocrine, and Obesity: Less GI disturbance than sucrose/other polyols, no increased hunger, reduced intestinal glucose absorption, and better gut epithelium function. Regarding endocrine: Low blood glucose (due to enhanced insulin secretion), Improved muscle glucose uptake/metabolism/enzyme activity; and Enhanced Glut-4 and IRS-1 expression. Regarding obesity: Less calories, matched taste, and possible weight reduction. (Next bit is part of gastrointestinal)
  Acetylsalicylic acid reportedly exacerbates gut permeability which absorbs more glucose. Hoshiko et al (2021) examined this via acetylsalicylic acid 'challenges' (25) where healthy participants had statistically significant higher blood sugars after taking aspirin. Obese/fatty livers increased gut permeability causing gamma-glutamyl transpeptidase (a liver enzyme) to leak into the bloodstream ($p=0.02$). Both factors could explain why some literature findings imply varied Erythritol effects. Saltiel and Olefsky (2017) believe chronic inflammation can cause obesity/metabolic syndrome (34). Associated responses lead to cell damage thereby changing physiological homeostasis (35) and affecting adiponectin and tumor necrosis factor in fatty tissue. This means plasma proinflammatory cytokines are higher in the diabetic/obese (36). Higher inflammation levels could provide explanations concerning Erythritol's dichotomous weight gain findings.
  Polyols have a low glycaemic and insulinaemic index, and Erythritol is the lowest (27). Arrigoni et al (2005) believe each gram of fully absorbed polyol are metabolized slowly yet fermented easily, and 100% is accessible as energy (28). Blood glucose therefore rises only slightly on consumption. Polyols do not ferment in the mouth, are not absorbed in the stomach, and only 10% is absorbed in the bowel (28). They are then excreted via the kidneys or transformed into glycogen/glucose in the liver depending on the polyol's structure (27). Unabsorbed polyol carbohydrate is usually completely fermented by colonic microflora. Livesey (2003) believes even small gastrointestinal differences are important because carbohydrates increase gut osmosis and muscle/glucose absorption (27). It is suggested that carbohydrates may also inhibit Erythritol's probiotic qualities if colonic

microvilli/flora decrease over time and more Erythritol may get absorbed. Those on long-standing high-carb diets may experience reduced Erythritol benefits. Conversely, Erythritol may promote lactic acid (due to fermenting carbohydrates) thereby sustaining healthy colonic epithelium as long-chain Butyric/Pentanoic/fatty acids. This regulates digestive tract motility, gut flora, and pathogen development by reducing the intestines' pH (22). Erythritol's Butyric acid level after 24hrs is different to other polyols, suggesting Erythritol has some unique qualities. High lactic acid levels long-term, however, could decrease probiotic qualities (27). Either way, gut actions play a crucial role in Erythritol metabolism.

- Cardiovascular and Endothelium: Wölnerhanssen et al (2021) believe Erythritol not only improves colonic/cardiovascular endothelial function but reduces aortic stiffness (19). Chukwuma et al (2018) found reduced glucose levels and improved endothelial function after taking 30g of Erythritol daily for 2-4 weeks 99). Heart rate, vascular resistance, stroke volume, and cardiac output increased thereby maintaining BP (11). These findings also suggest small vessel function improvements.
- Other/Antibacterial properties: Arrigoni et al (2005) found Erythritol resisted bacterial attack for 24hrs after ingestion which may explain why side effects, if any, are only usually within a 24-48hr window (28). Dental studies suggest Erythritol has antibacterial effects before the body metabolises it. Combining this with Livesey's (2003) findings suggests that Erythritol does not enter the usual carbohydrate/fat metabolism pathways (27).

4.2 Comments on Secondary Objectives

Evidently the daily 'safe' amount of 25g could be doubled without too many side effects. However, considering the maximum laxation thresholds, it may be better not to take 50g daily long-term. Erythritol's absorption process is not static: It appears to have 'no change' short-term, 'benefits' mid-term, but 'less effect' long-term. New knowledge gained centred on 8 related aspects: Biochemical marker actions, BMI, Appetite, Satiety, Energy consumption, Blood pressure (BP), Food cravings, and Gut action.

1.1.1. Biochemical marker actions

Glucose: Oliveira et al (2022) discovered Erythritol in chocolate does not raise glucose levels unlike glucose/sugar which raises blood sugar by 2mM> within 30 minutes and stays there for 120> minutes (18).

Insulin: Erythritol does not affect plasma glucose/insulin levels in insulin-resistant/Type II diabetics and improves insulin cell function (37, 7, 17). Therefore, even high Erythritol concentrations (75g) do not significantly raise blood sugar.

Leptin: This reduces satiety hence energy intake is more. Skuratovskaia et al (2021) showed obese type II diabetics have higher leptin levels, so feelings of 'being full' can be absent (38). Eating therefore continues because the brain believes it needs more energy. Furthermore, they believe leptin receptors are linked to inflammatory signalling pathways.

Ghrelin: This aids short-term homeostasis. Higher levels are needed to maintain the same response long-term in the obese as ghrelin weakens carbohydrate metabolism (37, 38). This ~~which~~ could be another explanation for dichotomous weight loss/gain.

1.1.2. BMI/Appetite/Satiety

Toews (2019) believes Erythritol either lowers/has no BMI effect during 6-24 months of continuous use for children aged 5+/adults, and only slight differences in pre-school children (mean=0.15) (7). However, both Toews (2019) and Azad et al (2017) report BMI increases in adults after that period (years 3-13) (7, 6). This suggests the optimum Erythritol effectiveness period for weight loss may be 2 years, and may decrease thereafter. BMI was not dependent on appetite and vice versa due to different pathways. Polyols did not generally invoke hunger signals (8).

1.1.3. Energy consumption

Losing weight when older can be difficult because metabolism slows so the body works harder to maintain homeostasis (39). If obese, high sugar intake can create vicious circles of energy intake (due to leptin levels). Satisfying this need induces hypothalamus deactivation for 12 minutes after ingestion, and higher blood glucose results (39). Erythritol induces the same initial hypothalamic response because of the sweet taste (7), but because Erythritol has virtually no calories the signal stops.

1.1.4. BP

Toews (2019) believes that Erythritol lowers BP (7). However, Azad et al (2017) believe it raises BP after 5-35 years of continuous use (6). If it is assumed that cumulative Erythritol is less effective after 3 years, both are true. Higher BP may also be the body's adaptation to Erythritol or other factors.

1.1.5. Food cravings

These rely on 'sweet taste' receptors in the tongue and enteroendocrine cells which play important 'nutrient sensing' and 'sugar absorption' roles. They supply energy, maintain normal metabolism, are activated by glucose, and release gut hormones. The body has the same response to sweet tastes with both glucose and Erythritol, but Erythritol induces satiety and has a much smaller sugar 'rush/high' (10). This does not, however, always reduce appetite in the obese due to higher leptins levels.

1.1.6. Gut action

Taking 30g of Erythritol for 2-4 weeks lowers small intestine glucose absorption, improves arterial endothelial function, reduces serum levels, and mesenteric artery blood flow doubles (9, 8, 11). Cholecystokinin (CCK), glucagon-like peptide 1 (GLP-1), and peptide tyrosine (PYY) reduce gastric emptying and the desire for further energy consumption (19). CCK reaches pre-ingestion levels at 90 minutes, but GLP-1 and PYY take 3hrs> to normalize (10). Wölnerhanssen's findings used power calculations and seem statistically significant (CCK p=0.001-0.048, and GLP-1 p=0.001-0.036) (19).

Erythritol seemingly counter-balances diabetics' dysfunctional insulin signaling pathway in several ways. It improves:

- glucose tolerance/modulated cardiac muscle expression (Glut-4)/IRS/mRNA) and protein synthesis resulting in improved muscle glucose uptake/metabolic enzyme activity (8, 9);
- liver glucose-6 phosphatase processes/glycogen storage/glucose-energy conversions (9). Molecules are negatively charged preventing them from exiting cells, thereby maintaining glucose levels;
- BP homeostasis. BP falls quicker in new diabetics (due to faster gastric emptying) and when carbohydrate is consumed (11) but Erythritol slows gastric emptying (9) therefore aiding BP homeostasis.

A crucial detail appears to be Akkermansia muciniphila (AM) which are beneficial bacterium. Low levels are linked to chronic diseases, obesity, type II diabetes, and high gut permeability (22). AM breakdown mucin into acetate which cells use to synthesize fatty acids/cholesterol and supply goblet cells with energy (22). This reduces hunger, which may avoid weight increase. Higher AM levels are found in lean people and those with normal glucose tolerance. AM's role in Erythritol's metabolism could therefore be very important.

4.3 Unique qualities/safety

Erythritol's metabolic profile is unlike any other polyol. Its impact on the hypothalamus and osmotic pressure is lower, it is virtually non-calorific, its molecular weight is different, and it has much higher digestive tolerance (24, 20, 21). These unique properties produced some unexpected but important findings:

- 'Diabetic versus non-diabetic', and 'Early-stage versus late-stage diabetic': Blood sugar, gut hormone, absorption kinetics/metabolic rates, and biochemical marker homeostasis is quicker in non-diabetics and early-stage diabetics (9);
- 'Obese versus lean': Satiety, blood sugar homeostasis, and 'sugar highs' take 30 minutes longer in the obese (7, 12, 13);
- 'Solids versus liquids': Erythritol displays different absorption kinetics/metabolic results: absorption is quicker with liquids and produces more side-effects. Maximum weight loss is likely when broken up over the day and taken in food.

These have important weight and health implications for patients, so amount (and possibly length of time using Erythritol) should be considered. Erythritol's safety was confirmed by the Joint WHO/FAO Expert Committee in 1999, and by many other Regulatory Authorities around the world (20). Clearly, Erythritol's unique properties make it the polyol of choice as it affords benefits on multiple body systems/processes.

4.4 Future study recommendations

Further work should be conducted with pre-school children and African, Australasian, and Southern American participants to ensure no differences are seen. These ages/countries were not well represented.

Obesity/fatty livers increased intestinal permeability, and 'aspirin-taking' increased blood sugar. Studies combining Aspirin, BMI, gut permeability, blood sugar, and length of Erythritol use could therefore be conducted. As chronic inflammation can cause changed physiological homeostasis cohort studies combining adiponectin, TNF, plasma proinflammatory cytokines, and long-term Erythritol use could be conducted for greater insight into possible weight gain.

As Ghrelin aids homeostasis but weakens carbohydrate metabolism in the obese (37) and the body responds similarly to both glucose and Erythritol, a large cohort study including the obese/diabetics to examine Akkermansia muciniphila, weight, BMI, and ghrelin/acetate levels would add further insight, as would studies comparing carbohydrate percentage and fermented food intake.

A new hypothesis could be that Erythritol is maximally effective for 2 years after which its effect decreases. Alternatively, the dichotomous literature findings concerning weight may be due to Carbohydrate, Ghelin, insulin, gut health, and blood glucose status.

4.5 Limitations

Whilst the reliability and generalisability of findings were robust, there were obvious knowledge gaps in the literature. Some full text papers were unavailable so some information may have been missed. Several studies fulfilled BEME rigor criteria outright, but some did not so their limitations have been described.

5 Conclusion

Clearly, the actions of Erythritol are very complex and affect a number of body systems simultaneously which have been described in this paper. This review established safe use/maximum daily recommended Erythritol intake for most ages. Providing the 'safe' thresholds were not exceeded no Erythritol disadvantages were seen, and those 11> stone may tolerate greater daily amounts without unacceptable side-effects. Reduced calories, delayed gastric emptying, healthier gut flora, and better glucose muscle absorption were seen when comparing Erythritol with sugar/sucralose/other polyols. Other Erythritol benefits included less dental biofilm build-up, enhanced insulin secretion, healthier gut and cardiac epithelium, lower blood sugar, and matched sweetness levels with sucrose. The mapping process performed was immensely useful as it elucidated whole body process links.

Implications

Erythritol provides some excellent advantages over all forms of sugar and other polyols, and has the potential to replace sugar for the nation's dietary needs and to aid weight reduction. The evidence found cannot categorically state yet that the body adapts to Erythritol over time. However as different Erythritol absorption rates/processes were found for 'lean versus obese', solids versus solutions' and 'diabetic versus non-diabetics', the following needs to be considered when estimating optimal Erythritol consumption amounts to calculate safe and nutritionally correct Erythritol dosage/amounts: BMI, Aspirin/inflammation/diabetic status including duration of disease, usual mode/amount of Erythritol intake, and length of time on a sugar-replacement/reduction diet. As 'feeling full', 'blood sugar homeostasis', and 'coming off sugar highs' can take 30 minutes longer in the obese (8), waiting 30 minutes before eating anything further could be suggested. Diabetics have increased gastric emptying speed and newer diabetics absorption is quicker than long-term diabetics so different Erythritol amounts may therefore be needed to produce similar effects.

Compliance with ethical standards

Disclosure of conflict of interest

This is an independent review with no outside funding.

Statement of ethical approval

This review conforms to all present guidance including the declaration of Helsinki and ~~GCP~~ Good Clinical Practice principles, and reporting and research conduct guidelines (EQUATOR/PRISMA).

Author's contribution

Review was designed, conducted, and analysed by Davina Calbraith (Freelance Researcher).

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