Research article Open Access

Scope review on Litesse polydextrose's impact on GLP-1 and other appetite-related parameters

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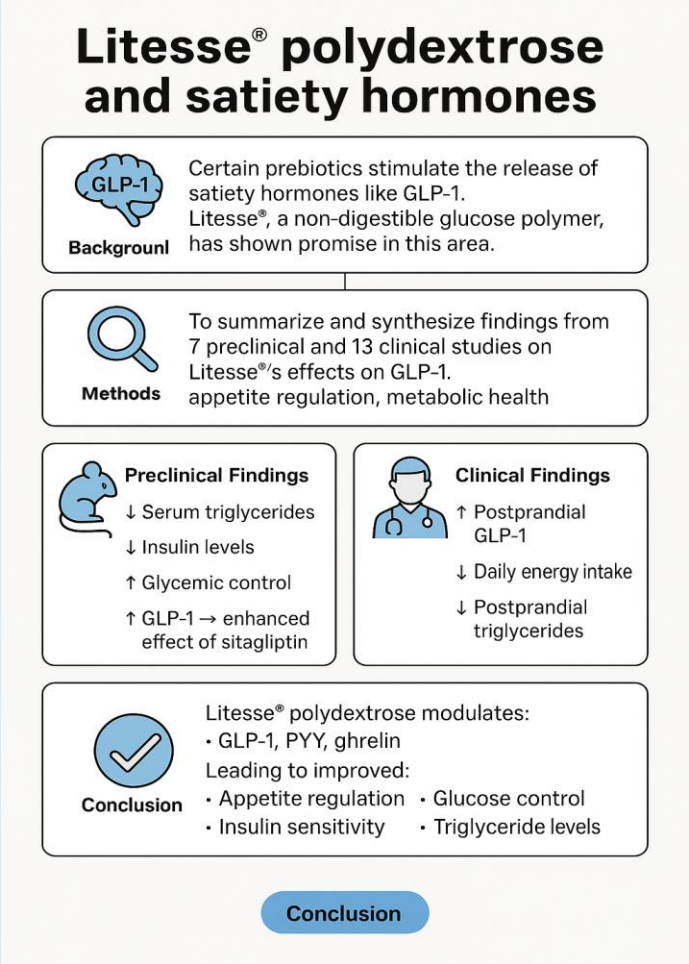
Submission Date: September 19th, 2025; **Acceptance Date:** November 13th, 2025; **Publication Date:** November 19th, 2025;

Please cite this article as: Ibarra A., Airaksinen K., Anjum M., Ouwehand A. C., Tiihonen K. Scope Review on Litesse Polydextrose's Impact on GLP-1 and Other Appetite-related Parameters. *Functional Food Science* 2025; 5(11): 647 – 657. DOI: https://doi.org/10.31989/ffs.v5i11.1786

ABSTRACT

Litesse® polydextrose has been documented to enhance the body's production of satiety hormones such as Glucagon-like peptide-1 (GLP-1). However, the combined results have not been reported concisely. This review aims to fill this gap. PubMed was searched for relevant articles in English. Seven preclinical and thirteen clinical articles were identified as relevant. Studies in rodents showed that Litesse leads to reduced serum triglycerides, lower insulin levels, and improved glycemic control, and enhances the effect of the type 2 diabetes drug sitagliptin on glucose tolerance and has the strongest impact on fasting glucose, likely via increased GLP-1. Further, feeding Litesse to mice reduced food intake and body weight. In humans, Litesse has been shown to increase postprandial GLP-1 release. This has been associated with a reduced daily energy intake and an improved post-prandial triglyceride response. A limitation is the relatively small size of the included studies. Litesse polydextrose has been shown to significantly affect gastrointestinal hormones such as GLP-1, PYY, and ghrelin. These hormonal changes are associated with improved appetite regulation, glucose control, insulin sensitivity, and triglyceride levels.

Keywords: Prebiotic; GLP-1; Appetite; Satiation; Satiety.



Graphical Abstract: Litesse® polydextrose and satiety hormones.

INTRODUCTION

Various satiety signals originate from the gastrointestinal tract in response to food intake. In addition to physical signaling, satiety, appetite, and energy metabolism are influenced by hormones secreted by intestinal enteroendocrine cells. These cells sense nutrients and metabolites produced by intestinal microbes.

Glucagon-like peptide-1 (GLP-1) is the primary incretin hormone secreted from the intestine after food intake. GLP-1 delays gastric emptying, reinforces the feeling of fullness, and thereby reduces food intake. Additionally, it enhances insulin secretion from pancreatic beta cells, helping to lower blood glucose levels. Elevated circulating GLP-1 levels have been established as a therapeutic strategy to improve glycemic control in patients with diabetes [1]. GLP-1 also modulates liver metabolism and can help lower cholesterol levels by reducing circulating triglycerides. Besides GLP-1, peptide YY (PYY) and cholecystokinin (CCK) can suppress hunger [2]. Ghrelin has the opposite

effect: it rises before meals to stimulate hunger and decreases after meals [3].

Litesse®, chemically classified as polydextrose, is a carbohydrate polymer that is not digested in the small intestine but is slowly fermented into short-chain fatty acids (SCFAs) and other metabolites by colonic microbiota [4]. These metabolites can stimulate GLP-1 secretion from enteroendocrine cells in the lower GI tract. Cani et al. [5] showed a transient increase in GLP-1 and PYY after fructo-oligosaccharide supplementation. However, previous prebiotic interventions have shown mixed effects on GLP-1 secretion (Figure 1) [6].

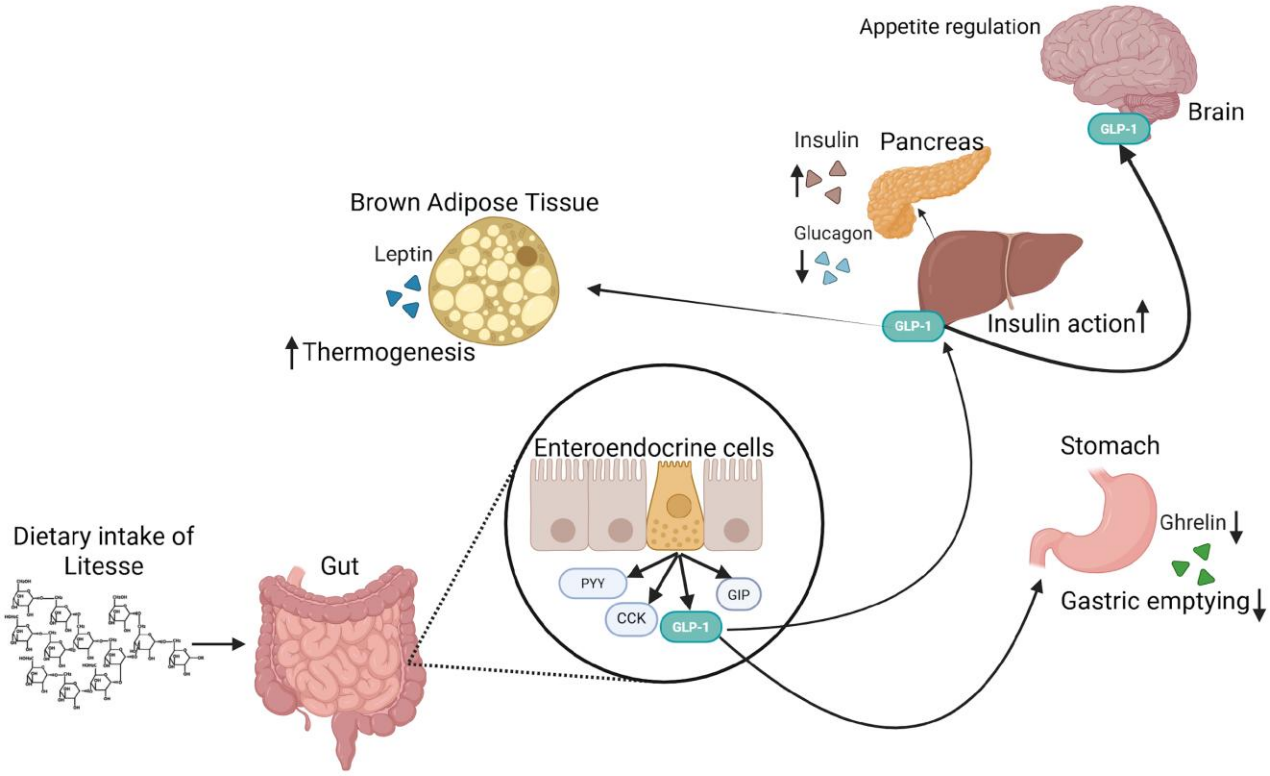


Figure 1. Role of glucagon-like peptide-1 (GLP-1) in human metabolism. Figure created using Biorender.

Polydextrose is a highly branched glucose polymer containing various types of glycosidic bonds, with 1,6 bonds predominating. The average degree of polymerization of polydextrose is approximately 12, and the average molecular weight is 2000 Daltons. Polydextrose is very stable at low pH and high temperature compared to linear and regular glycosidic polymers. It resists digestion in the upper gastrointestinal tract and is partially fermented in the colon, providing 1 kcal/g of energy [7]. The regulatory interpretation of this may vary from region to region, depending on how Litesse is used in the end application. The complex structure of poydextrose confers functional and physiological benefits such as fecal bulking [8]. Fibers are essential bioactive compounds in functional foods and are present in many plants, and to a lesser extent in foods of fungal origin [9]). Polydextrose can enrich functional foods in fiber. The official AOAC fiber method has been developed further to quantify polydextrose as fiber in foods [10]. The manufacturing of polydextrose may include varying methods of condensation reactions, raw materials, catalysts, and post-reaction clean-up. Litesse is

a branded polydextrose that is produced solely from high-purity corn-based raw materials using methods that do not require buffering or carbon treatment to achieve the final product pH and color. This process results in significantly lower levels of sodium and potassium compared with buffered products. Consequently, the various grades of Litesse that are used for different applications have a defined composition and polymeric structure compared to other polydextrose variants (Table 1). The chemical composition and technical specifications for Litesse and Litesse Two are actually very similar; taste is typically the biggest differentiator, and pH is the only discernible physicochemical difference. To improve taste and reduce color, Litesse® Ultra™ undergoes catalytic hydrogenation, which converts the terminal glucose units on its polydextrose chains—and most of the free glucose—into sorbitol, making it sugar-free.

An early systematic review indicated that selected prebiotics may increase plasma GLP-1 levels [11]. This has, however, not been studied specifically for Litesse, although Litesse has been reviewed in a meta-analysis to influence satiation and appetite [12]. The current review focuses therefore on the influence of Litesse on GLP-1 and other satiety markers. There is a bidirectional influence between satiety hormones and immune function and intestinal SCFA. Litesse has been documented to influence immune function and SCFA levels [13-15].

Table 1. Characteristics of the three grades of Litesse polydextrose: Litesse, Litesse Two, and Litesse Ultra.

	Litesse	**Litesse Two**	**Litesse Ultra**
Taste	Bland / Neutral	Clean /Mildly Sweet	Very Clean /Mildly Sweet
Color	Cream	Cream	White
pH (10% solution)	3.0 – 4.5	3.5 – 5.0	4.5 – 6.5
Stability of solution (at 25°C)	n/a	12 months	6 months
Residual sugars	Maximum 4%	Maximum 4%	Maximum 0.25%
Maillard reaction	Yes	Yes	No

METHODS

This review adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews (PRISMA-ScR) [16]. As this is a scope review, it was not registered in Prospero. PubMed was the primary source of information. The search keywords included “Polydextrose”, “GLP-1”, “PYY”, “Ghrelin”, and “Cholecystokinin”. Additionally, “Glucose”, “Insulin”, “Triglycerides”, and “Appetite” were used as supportive terms. The search was limited to articles in English and aimed to select pre-clinical and clinical studies. The search ran from January 7 to February 28, 2025, (K.A. and K.T.). conducted by one author (A.I.) and verified by two others

RESULTS

It identified 119 records in PubMed and three from other sources. As all records indicated, the studies reporting incretins used Litesse polydextrose. This product range served as the foundation for constructing this review. Figure 2 shows the selection process. Seven pre-clinical studies were identified, of which two analyzed satiety hormones [17-18] and five provided supportive information on the benefits of polydextrose [19- 23].

Thirteen clinical studies were included; nine reported satiety hormone levels [24- 2] (see Table 2), while four supported the review discussion [33- 36]. The number of subjects in the included studies ranged from 10 to 66 (mean 28). All were adults.

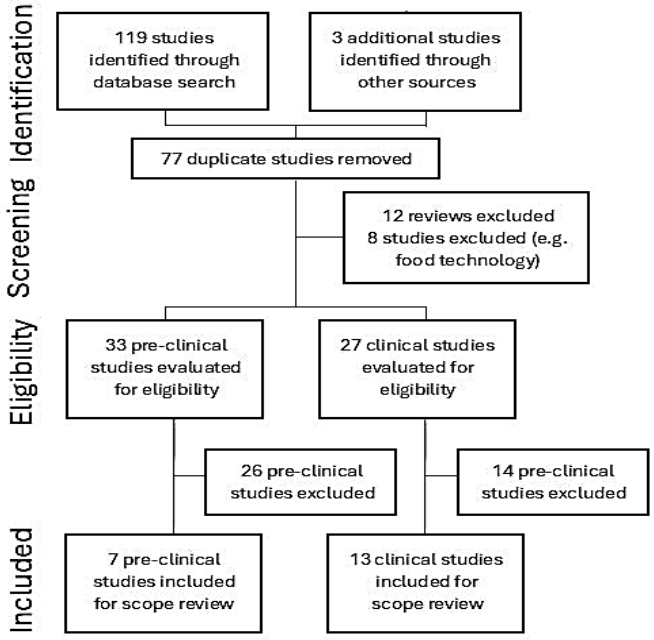


Figure 2. Record selection process in the scope review.

Table 2. Clinical studies on the effects of Litesse polydextrose on gastrointestinal peptides and appetite-related parameters

Study	Investigational Products	Population	Design	Main outcomes
Ibarra et al., 2017	0g PDX or 12.5g PDX in non-fat yogurt	32 adults	An acute, randomized, double-blind, placebo-controlled study with four-arms crossover study	PDX increased GLP-1 compared to placebo. PDX intake tended to elevate blood glucose post-prandially, but significantly lowered insulin compared to placebo. PDX suppressed hunger during the satiation period.
Soong et al., 2016	0g PDX or 12g PDX with 15.g protein or 30.8 protein	27 adults	Acute, repeated-measures, randomized, cross-over study	PDX increased plasma GLP-1. PDX enhanced the suppression of ghrelin.
Olli et al., 2015	0g PDX or 15g PDX in a cola drink	18 adults	Acute, randomized, double-blinded, placebo-controlled, and crossover study	PDX increased GLP-1 secretion compared to the placebo. No significant differences in ghrelin, CCK, or PYY levels between placebo and PDX. PDX reduced iAUC for hunger by 40% (P = 0.03)
Astbury et al., 2013	0, 6.3, 12.5, and 25.0 g PDX in a chocolate milkshake	21 adults	Randomized within subject, single-blind, cross-over design	Mean energy intake was reduced with all tested doses PDX compared to control. Total daily energy intake was higher in the control group compared to 12·5 and 25 g PDX.
Astbury et al. 2014	6.2g PDX in a protein bar, control no protein no PDX bar	10 adults	Acute, double-blind, randomized, cross-over study	PDX increased levels of plasma PYY and reduced plasma levels of ghrelin compared to control. Reduced total daily energy intake.

Study	Investigational Products	Population	Design	Main outcomes
Hull et al. 2012	0g PDX, 6.25g PDX or 12.5g PDX in drinking yogurt	34 adults	Randomized, single-blinded, placebo-controlled, cross-over study	PDX increased satiety and decreased appetite compared to control. Reduced energy intake.
King et al. 2005	12.5g xylitol+12.5gPDX or 25g xylitol or 25g PDX in yogurt	15 adults	Cross-over study	PDX reduced energy intake compared to control. No effect on fullness.
Ranawana et al. 2013	0g PDX or 12g PDX in a fruit smoothie	26 adults	Single-blind, randomized-controlled, cross-over study	PDX reduced energy intake, no effect on subjective feelings of hunger, fullness, desire to eat and prospective food consumption.
Schwab et al. 2006	16g sugar beet pectin or 16 PDX or control	66 adults	Placebo-controlled, randomized, parallel, double-blind study	No effect on energy intake, control, and PDX reduced bodyweight, BMI, and LDL-cholesterol. Reduced feeling of hunger in the PDX group. Plasma glucose remained stable in the PDX group but increased significantly in the control.

Abbreviations: AUC, area under curve; CKK, Cholecystokinin; GLP-1, glucagon-like protein-1; iAUC, incremental area under the curve; PDX, Litesse polydextrose; PYY, peptide YY

DISCUSSION

Our research on the effects of polydextrose on appetite hormones revealed that all studies used Litesse products. Litesse Ultra, a dietary fiber supplement, has shown a notable impact on the release of gastrointestinal peptides, also known as incretins, particularly GLP-1, in both pre-clinical [17, 37] and clinical studies [24-27].

Olli and co-workers [26] reported that Litesse consumption by non-diabetic obese volunteers resulted in statistically higher plasma GLP-1 levels than in the placebo group. This resulted in reduced feelings of hunger throughout the study (280 min) and higher post-meal satiety (Table 2). Likewise, Ibarra and co-workers [25] observed an increase in blood GLP-1 and PYY levels in normal and obese women when Litesse was consumed at breakfast. Litesse consumption as a mid-morning snack provided reduced hunger during satiation (Table 2). Also, Soong and co-workers [27] observed that the consumption of Litesse by normal weight volunteers resulted in increased levels of plasma GLP-1 and reduced levels of ghrelin (Table 2). In a human clinical trial, PDX-containing snack bars reduced the total daily energy intake in healthy men versus those who consumed the snack bar without PDX [24]. In addition to low daily energy intake, glucose and ghrelin levels were reduced, while GLP-1 and PYY responses increased, suggesting that a PDX-containing snack may be a helpful addition to a weight-loss regimen [25]. Litesse has been documented to be fermented by the intestinal microbiota and to yield short-chain fatty acids, including butyrate [4]. Butyrate has been reported to stimulate GLP-1 production [38] and could provide an underlying mechanism for the increase in GLP-1 upon Litesse consumption. Further, Albarracin et al. [19] showed increased calcium absorption after Litesse administration and an increase in bone mineral density compared to control and other test diets. Also, this may be related to elevated plasma GLP-1 levels [39]. Litesse is well tolerated in study participants; no symptoms of gastrointestinal distress have been reported, even at high doses, with a mean laxative threshold of 50 g in a single dose [28, 33, 40].

In addition to its impact on satiety hormones, including GLP-1, Litesse also caused a clinically meaningful reduction in energy intake, and the proposed

mechanism is mediated by changes in satiety hormones [29]. Foods supplemented with Litesse significantly suppressed food intake compared with a control group, making it an attractive ingredient for functional foods targeting appetite control [30]. Litesse was shown to influence short-term energy intake in a dose-dependent manner and may be a beneficial ingredient to include in foods designed to limit subsequent energy intake [28]. The total energy intake was also decreased significantly in another clinical study where polydextrose was added to snacks [24], suggesting that polydextrose-containing foods can be helpful in weight management. A clinical trial by Ranawana et al. [32] also observed that consuming foods supplemented with Litesse led to a significantly lower energy intake at lunch compared to the control group. This is all in line with the general effects of fiber on satiety, appetite, and energy intake. These effects are commonly short-term (<4h) [41] and thus follow the physiological evolution of satiety hormones as described here. Moreover, there was no change in food taste or texture, making polydextrose compatible with various food matrices. The study, however, failed to show a change in satiety, as assessed by subjective hunger, fullness, desire to eat, and prospective food consumption sensations reported by participants in both the treatment and control groups [32].

In participants with abnormal glucose metabolism, Litesse was observed to maintain fasting plasma glucose levels, while it increased in the control group [31]. This may suggest a potential role for Litesse in maintaining metabolic health. Tiihonen et al. [36] showed that 12.5-15g Litesse supplementation in normolipidemic, overweight/hyperlipidemic, and obese/non-diabetic subjects was one of the factors that significantly reduced triglyceride response compared to the placebo treatment ($p < 0.05$). Another study that used an intervention of jams supplemented with multiple sugars or Litesse, showed a range of glycemic indices. The level of blood glucose in healthy individuals showed a significantly higher peak with jam containing all other carbohydrates as compared to the Litesse containing jam [34].

Pre-clinical studies have explored the effects of Litesse on gastrointestinal hormones, such as GLP-1 and PYY, and associated these effects with appetite regulation, glucose control, insulin sensitivity, and triglyceride levels. GLP-1 is an incretin hormone that enhances insulin secretion and regulates blood glucose levels [1]. Research conducted by Olli et al. [17] in rats and Stenman et al. [37] in mice showed that Litesse leads to reduced serum triglycerides, lower insulin levels and improved glycemic control. These findings highlight the potential of Litesse in improving glucose tolerance and insulin sensitivity. The gut releases PYY in response to food intake and reduces appetite levels [2]. Olli et al. [17] did not observe a significant effect on PYY but reported a reduction in feed intake and body weight gain following Litesse consumption. Research by Stenman and co-workers (37) showed that Litesse, in combination with the probiotic *Bifidobacterium lactis* 420, improved glycemic control and fasting glucose in mice. Additionally, Litesse enhanced the effect of the type 2 diabetes drug sitagliptin on glucose tolerance and had the most substantial impact on fasting glucose, likely via increased GLP-1. Also, Yde et al. [23] reported reduced body weight gain and hepatic fat accumulation in mice when Litesse was combined with *B. lactis* 420. Litesse, combined with *B. lactis* 420, contributed to microbiota modulation, and Litesse was shown to modulate gut bacteria, increasing levels of the beneficial *Akkermansia* [23]. *Akkermansia* is a known propionate producer, which is one of the ways it drives its health benefits [42]. Bamba et al. [20] showed that Litesse does not impact the activity of brush border membrane enzymes of the small intestine in rats and induces no effect on the thickness of the unstirred water layer. Additionally, it does not inhibit glucose absorption.

In pre-clinical models, Litesse's ability to modulate GLP-1, PYY, and ghrelin suggests it can effectively influence appetite control. The increased levels of GLP-1 and PYY, coupled with reduced ghrelin levels, create a hormonal environment conducive to satiety and reduced food intake. This makes polydextrose a promising dietary fiber, especially for people with diabetes. Furthermore, Litesse's impact on lipid metabolism has been explored in several studies. Litesse has been shown to maintain low postprandial blood glucose levels [33] and to decrease food intake due to its satiety effect [22, 26]. An intervention, where Litesse was given to high-fat diet-fed mice mimicking western diets, led to attenuated body weight gain [22]; such an effect was, however, not replicated in humans [43]. Litesse supplementation induced beneficial shifts in the gut microbiota and intestinal gene expression, resulting in improved lipid profiles and reduced fat accumulation. These effects are likely mediated by microbial fermentation products like SCFAs, which influence host metabolism [44].

A limitation of the review is that the studies included are relatively small. Although this is not unusual in nutrition studies, larger studies are certainly desirable. Further, all involved adult volunteers. Little can be concluded about the effect of Litesse on satiety hormones and appetite in young and senior consumers.

Fibers have both health benefits, as discussed in the current work, and technological benefits. Fibers, including Litesse, can be included in multiple functional foods addressing, among others, metabolic syndrome and obesity related health issues [45]. Helping consumers to eat a healthier diet [46].

CONCLUSIONS

This is the first review to focus on the effects of the defined fiber Litesse polydextrose on gastrointestinal hormones. Litesse showed significant effects on GLP-1, PYY, and ghrelin expression in both animal and human studies. These hormonal changes are associated with improved appetite regulation, glucose control, insulin sensitivity, and triglyceride levels. Litesse is a scientifically validated, multifunctional dietary fiber that modulates key appetite pathways, particularly by enhancing GLP-1 secretion. The evidence from various studies suggests that Litesse could be a valuable nutritional component in managing diabetes, weight, and cardiovascular health. Future research should focus on dose optimization and personalized nutrition approaches to maximize its clinical utility.

List of Abbreviations: CCK, Cholecystokinin; GLP-1, Glucagon-like peptide-1; iAUC, incremental area under the curve; PDX, polydextrose; PYY, Peptide YY; SCFA, Short-chain fatty acid; VAS, Visual Analogue Scale; XYL, Xylitol.

Competing Interest: All authors are or were employees of IFF, the company that produces Litesse.

Author Contributions: Conceptualization, A.I., K.A. and K.T.; methodology, A.I., K.A. and K.T.; software, A.I..; validation, A.I., K.A., M.A., A.C.O., and K.T.; formal analysis, A.I; writing—original draft preparation, A.I., K.A. and K.T.; writing—review and editing, A.I., K.A., M.A., A.C.O. and K.T.; visualization, A.I., M.A. All authors have read and agreed to the published version of the manuscript.

Acknowledgments: The authors acknowledge Stuart Craig, Jyrki Kuusisto, Mary Jacob, Gary Reid, and Charles Thurstone for their valuable technical information on Litesse.

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