PAPERS PUBLISHED

Dey and Sheth
Food Production, Processing and Nutrition (2023) 5:8
https://doi.org/10.1186/s43014-022-00117-w

Food Production, Processing and Nutrition

RESEARCH Open Access

Development of Galactooligosaccharide (GOS) added gummies: sensory, characterization and shelf quality

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Abstract

Sugar loaded confectioneries have a rapidly growing market globally. Consumption of such products may lead to multiple health risks. Products like gummies can be substituted with healthy sugar alternatives such as Galactooligosaccharide (GOS), which can be consumed by all age groups.

The aim of the study was to develop standard gummies and sugar substituted gummies, conduct sensory analysis, shelf life studies and characterize it for its physico chemical properties.

The standard gummies were made using agar, sugar, citric acid, water, and FSSAI (Food Safety Standards Authority of India) certified natural colours and flavours, while GOS supplemented gummies were made by replacing sugar in varied amounts, upto 100%. A trained panel ($n = 8$) evaluated the gummies using a composite score card in triplicates for a variety of sensory attributes. GOS recovery analysis, physicochemical variables such as colour, moisture, pH, and texture were assessed. Shelf life Studies of 100 percent GOS supplemented gummies were carried out at accelerated temperatures (37 °C) over a period of 6 months.

The results revealed that gummies with varying levels of GOS were acceptable to the panelists, with no significant differences in the keeping quality. However, F test revealed a significant improvement ($p < 0.05$) in the texture of the gummies with a slight reduction in colour and flavour at the end of 6 months. The moisture content and pH values were 24.8% and 3.37 respectively. HPLC analysis revealed a recovery of 95% GOS in the prepared gummies.

Hence, sugar can be substituted with 100% GOS to fulfil the increasing demand for healthy confectioneries without any change in organoleptic qualities and shelf life for 6 months.

Keywords: Gummy, Galactooligosaccharide, Shelf life, Sensory, Prebiotics, Physico-chemical

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Nutrire (2024) 49:7
https://doi.org/10.1186/s41110-024-00253-y

RESEARCH

Role of chrononutrition and lifestyle factors in functional constipation

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Received: 26 August 2023 / Accepted: 3 January 2024 / Published online: 10 January 2024

Abstract
Functional constipation is a common public health problem which may reduce one's level of productivity and quality of life. Chrononutrition profile involves the relationship between one's circadian rhythm and the dietary pattern. The objective of this study is to explore the association between chrono nutrition profile and lifestyle pattern of constipated subjects. University teaching faculty ($n=364$) was screened using a cross-sectional study design and purposive sampling technique. A pre-tested and validated structured questionnaire was administered to them bearing questions related to their constipation status, chrononutrition profile and lifestyle pattern including diet and physical activity. The data obtained was subjected to statistical analysis using JASP software 2022. The background information of the study participants revealed that most of the respondents were females (59.1%), married (73.1%) and stayed in nuclear families (62.1%) with a family income of > INR 123,322.00 (42.3%) and their age ranged between 35 and 64 years. Functional constipation was observed in 25% of the subjects ($n=90$). Physical activity of the study subjects indicated that 83% and 17% were in the sedentary and mildly active categories respectively and it was significantly negatively correlated with presence of FC among the subjects ($p<0.05$). No significant correlation was observed with constipation in terms of the working day profile, whereas in terms of a free day profile, chrono nutrition profile showed a significant association ($p<0.05$). However, the type of diet consumed by the subjects did not show any significant association with the constipation profile. Functional constipation was observed in 1/4 of the study sample. The findings suggest an association with a poor chrono nutrition profile with the constipation status of the study population on a free day. Further advice can be given to subjects suffering from constipation to improve their lifestyle pattern consistently on both working and free days.

Keywords Constipation · Diet · Chrono nutrition · Circadian rhythm · Sleep pattern · Exercise · Lifestyle

Introduction

Functional constipation (FC) is a significant clinical and public health issue. It is a very common functional gastrointestinal condition that could have a major impact on both the cost and quality of life [1]. Constipation is not just a problem for the elderly; it may also affect people in their middle years and young adults. Hard stools or scybala (hard, inspissated stool), unsuccessful calls (wanting to but unable to), cylindrical and cracked or cylindrical and thick stools, frequency of bowel movements less than three times per week, and straining for more than 25% of the time are all considered to be objective and subjective indicators of constipation [2].

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Constipation has a multifaceted pathogenesis, with particular emphasis on genetic predisposition, socioeconomic level, poor fiber intake, inadequate fluid intake, immobility, disruption of the hormone balance, drug side effects, or body structure [3]. An important requirement to consider when examining the eating habits and sleep schedule of constipation sufferers is their chrononutrition profile [4].

Based on the principles of chrononutrition principles, time restricted eating (TRE) is a practical and well-tolerated diet that has multiple beneficial health advantages [5]. However, more thorough research is required to verify these effects, comprehend their processes, and determine whether they have any bearing on human health [6]. Circadian rhythms control a large portion of the physiology of the gastrointestinal tract, including cell growth, motility, digestion, absorption, and electrolyte homeostasis [7].

The "chronotype" of a person influences chrononutrition. A person's chronotype is an analysis of their circadian

Randomized Controlled Trial > Indian J Gastroenterol. 2023 Dec;42(6):839-848.
doi: 10.1007/s12664-023-01435-8. Epub 2023 Sep 26.

Daily consumption of galactooligosaccharide gummies ameliorates constipation symptoms, gut dysbiosis, degree of depression and quality of life among sedentary university teaching staff: A double-blind randomized placebo control clinical trial

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PMID: 37751049 DOI: 10.1007/s12664-023-01435-8

Abstract

Background: Functional constipation affects approximately 10% of the Indian population and may reduce the quality of life (QOL) and increase gut dysbiosis. PURPOSE OF STUDY: The study aimed at assessing the impact of galactooligosaccharide (GOS) gummy supplementation on gut health, depression status and QOL of constipated subjects.

Methods: A double-blind placebo control clinical trial (CTRI/2021/10/037474) was conducted on sedentary constipated adults (n = 35), who were split into an experimental group (n = 17) and a control group (n = 18), supplemented with 10 g GOS and sugar gummies, respectively, for 30 days. Relative abundance of fecal gut microbes, including Bifidobacterium, Lactobacillus, Clostridium and Bacteroides and phyla Bacteroidetes and Firmicutes using real-time polymerase chain reaction and short-chain fatty acids, was analyzed pre and post supplementation. Constipation profile was studied using Rome IV criteria and the Bristol stool chart. Depression status was studied using the Becks Depression Inventory. The QOL was assessed using patient assessment of constipation.

Results: GOS gummy supplementation increased Bifidobacterium and Lactobacillus by 1230% and 322%, respectively, ($p < 0.001$; $p < 0.01$) with reduced Clostridium by 63%, phylum Firmicutes by 73% and Bacteroidetes by 85% ($p < 0.01$). The GOS-supplemented group demonstrated a higher F/B ratio (4.2) indicating improved gut health ($p < 0.01$) with reduced gut dysbiosis and constipation severity. GOS gummies enhanced acetic acid and butyric acid levels compared to the control group ($p < 0.01$; $p < 0.001$). Post supplementation, there was 40% reduction in depression ($p < 0.01$) and 22% improvement in QOL ($p < 0.05$).

Conclusions: This research validates the predicted beneficial benefits of short-term GOS consumption on constipation profile, gut microflora, depression status and quality of life of constipated subjects.

Keywords: BDI; Chronic constipation; Depression; Galactooligosaccharide; Gut dysbiosis; Idiopathic constipation; Prebiotics; QOL; Real-time PCR; SCFA; Sedentary lifestyle.