Diversitas Journal
ISSN 2525-5215
Volume 9, Issue 2 (apr./jun. 2024) p. 0967 – 0975
https://diversitasjournal.com.br/diversitas_journal

Saturated and monounsaturated fatty acids in human milk after gastric bypass: a case study.

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ABSTRACT

The Roux-en-Y gastric bypass is one of the most commonly used techniques in bariatric surgery for the treatment and control of obesity, involving restriction and malabsorption. Some studies have evaluated the micronutrient content and polyunsaturated fatty acids of human milk in women who have undergone bariatric surgery, but data about the saturated and monounsaturated fatty acids in nursing mother who underwent bariatric surgery human milk have been lacking. In this case, we quantify the content of saturated and monounsaturated fatty acids in the stages of lactation: colostrum, transitional milk, and mature milk of a nursing mother undergoing gastric bypass surgery in Y-de-Roux two months before pregnancy. The participant had 29-year-old. In December 2017, she underwent Roux-en-Y gastric bypass surgery, and, 2 months after the procedure, she became pregnant. Fatty acids were quantified on the Perkin Elmer Autosystem XL Chromatograph. High concentrations of myristic fatty acid and lower levels of trans fatty acids were observed in the human milk of women in our study compared to the milk of mothers who did not undergo bariatric surgery. We cannot state that the composition of fatty acids found in this case report reflects the composition of fatty acids in the human milk of all women who underwent BS. More studies are needed to better assess the implication of BS in the composition of fatty acids in human milk.

RESUMO

O bypass gástrico em Y-de-Roux é uma das técnicas mais utilizadas em cirurgia bariátrica para tratamento e controle da obesidade, envolvendo restrição e má absorção. Alguns estudos avaliaram o conteúdo de micronutrientes e ácidos graxos poliinsaturados do leite humano em mulheres submetidas à cirurgia bariátrica, mas os dados sobre os ácidos graxos saturados e monoinsaturados no leite humano de nutrizes submetidas à cirurgia bariátrica ainda são escassos. Neste caso, quantificamos o conteúdo de ácidos graxos saturados e monoinsaturados nas fases da lactação: colostro, leite de transição e leite maduro de uma nutriz submetida à cirurgia de bypass gástrico em Y-de-Roux dois meses antes da gravidez. A participante tinha 29 anos e em dezembro de 2017 foi submetida à cirurgia de redução do estômago em Y-de-Roux e, 2 meses após o procedimento, engravidou. Os ácidos graxos foram quantificados no cromatógrafo Perkin Elmer Autosystem XL. Altas concentrações de ácido graxo mirístico e níveis mais baixos de ácidos graxos trans foram observadas no leite humano da mulher do nosso estudo em comparação com o leite de mães que não foram submetidas à cirurgia bariátrica. Não podemos afirmar que a composição de ácidos graxos encontrada neste relato de caso reflete a composição de ácidos graxos do leite humano de todas as mulheres que apresentaram SB. Mais estudos são necessários para melhor avaliar a implicação da SB na composição dos ácidos graxos do leite humano.

ARTICLE INFORMATION

Article process:
Submitted: 03/07/2024
Approved: 06/26/2024
Published: 06/28/2024

Keywords:
gastric bypass; human milk; trans fatty acids, fatty acids monounsaturated.

Palavras-chave:
Bypass gástrico, leite humano, ácidos graxos trans, ácidos graxos monoinsaturados.

DOI: 10.48017/dj.v9i2.2973

Introduction

Currently, bariatric surgery (BS) is considered the most effective tool for the control and treatment of severe obesity and its comorbidities (Carswell et al., 2016).

Roux-en-Y gastric bypass (RYGB) is a mixed surgical technique that restricts the size of the gastric cavity and, consequently, the amount of food ingested, in addition to reducing the intestinal surface that comes into contact with food (disabsorption) (Bordalo et al., 2011).

Recently, Oliveira et al. (2023) investigated the polyunsaturated fatty acids (PUFAs) in human milk (HM) of nursing mothers after BS, respectively. However, after analyzing the database, no studies were found so far that quantify saturated fatty acid (SFA) and monounsaturated fatty acid (MUFA) in HM of women undergoing BS.

Thus, we opted to quantify SFA and MUFA in the stages of lactation: colostrum (COL), transitional milk (TM), and mature milk (MM) of a nursing mother undergoing gastric bypass surgery in Y-de-Roux two months before pregnancy.

This study was approved by the Ethics Committee of the National Institute for Women, Children and Adolescents Health Fernandes Figueira/Oswaldo Cruz Foundation - IFF/Fiocruz (No. CAAE: 56999422.9.0000.5269). We obtained the participant's written informed consent to publish her data.

Development

History Assessment

This is a 29-year-old woman in, her third pregnancy. In December 2017, she underwent Roux-en-Y gastric bypass surgery, and, 2 months after the procedure, she became pregnant.

Prenatal care began at National Institute for Women, Children, and Adolescents Health Fernandes Figueira/Oswaldo Cruz Foundation - IFF/Fiocruz, from the 29th gestational week onwards. At 30 weeks of gestation, she began to receive nutritional care at the IFF. The general characteristics of the present case are described in detail in the primary study by Oliveira et al. (2023).

Management

Colostrum (COL) (2ml), transitional milk (TM) (4ml), and mature milk (MM) (4ml) samples were obtained by manual expression of the breast that was not sucked in the last feeding, in the morning, and placed in Eppendorfs-type microtubes.

All milk samples were immediately stored in a -20°C freezer and then transported on ice to the Nutritional Biochemistry Laboratory of the Josué de Castro Institute of Nutrition/Federal University of Rio de Janeiro - INJC/UFRJ, where they remained stored at -80°C, until separation of lipids and quantification of fatty acids (FAs).

For analysis of FAs, the techniques described by Folch et al. (1957) and Lepage and Roy (1986). FAs methyl esters (FAME) were quantified on the Perkin Elmer Autosystem XL Chromatograph, as described in another study (Costa et al., 2011).

FAs concentrations were expressed as the percentage of the total area comprising all FAs peaks (% of total FAME).

Outcomes

The fatty acid composition of colostrum, transitional, and mature milk samples of nursing mother are presented in **Table 1**.

Table 1:

Composition (%) of saturated and monounsaturated fatty acids in colostrum, transition milk and mature milk samples of mother.

SATURATED FATTY ACIDS (SFAs)	COLOSTRUM (mean ± SD)	TRANSITION MILK (mean ± SD)	MATURE MILK (mean±SD)
C5:0 (valeric)	12.57±0.32	23.78±0.68	12.81±0.63
C6:0	0.07±0.01	0.12±0.01	0.06±0.01
C7:0	0.03±0.01	0.12±0.01	0.06±0.01
C8:0	0.01±0.01	0.07±0.01	0.06±0.01
C10:0	0.19±0.01	1.06±0.03	1.07±0.05
C11:0	0.01±0.01	0.01±0.01	0.01±0.01
C12:0 (lauric)	3.11±0.08	5.60±0.16	5.91±0.29
C14:0 (myristic)	16.82±0.43	18.90±0.54	14.56±0.72
C15:0	0.22±0.02	0.17±0.02	0.18±0.02
C16:0 (palmitic)	15.29±0.41	11.17±0.33	13.95±0.69
C17:0	0.17±0.01	0.13±0.01	0.15±0.01
C18:0 (stearic)	2.85±0.07	3.10±0.09	3.02±0.14
C20:0	0.02±0.01	0.02±0.01	0.03±0.01
C22:0	0.03±0.01	0.03±0.01	0.04±0.01
Total Saturated Fatty Acids (%):	**51.4**	**64.28**	**51.91**

MONOUNSATURATED FATTY ACIDS (MUFAs)	**COLOSTRUM** (mean ± SD)	**TRANSITION MILK** (mean ± SD)	**MATURE MILK** (mean ± SD)
C13:1	5.03±0.13	4.90±0.14	5.07±0.25
C14:1 9t	0.04±0.01	0.04±0.01	0.04±0.01
C14:1	0.11±0.01	0.11±0.01	0.14±0.01
C16:1 9t	0.05±0.01	0.04±0.01	0.04±0.01
C16:1 11t	0.48±0.01	0.31±0.01	0.39±0.02
C16:1 9c	2.00±0.06	1.58±0.05	2.55±0.12
C17:1 10c	0.12±0.01	0.10±0.01	0.14±0.01
C18:1 6t + C18:1 8t	0.03±0.01	0.01±0.01	---
C18:1 9t (Elaidic)	0.07±0.01	0.03±0.01	0.01±0.01
C18:1 10t	0.04±0.01	0.01±0.01	0.02±0.01
C18:1 11t (vaccene)	0.10±0.01	0.05±0.01	0.01±0.01
C18:1 13t + C18:1 14t	0.02±0.01	---	0.02±0.01
C18:1 9c 9 (oleic)	25.13±0.64	17.80±0.51	23.18±1.14
C18:1	1.42±0.04	0.94±0.03	1.25±0.07
C20:1	0.01±0.01	0.01±0.01	0.01±0.01
C20:1	0.01±0.01	0.01±0.01	0.02±0.01
C20:1	0.44±0.01	0.22±0.01	0.27±0.01
Total *Trans* Monounsaturated Fatty Acids (%):	**0.83**	**0.49**	**0.53**
Total Monounsaturated Fatty Acids (%):	**35.10**	**26.16**	**32.86**

Note: Results expressed as mean ± Standard Deviation (SD). (SFAs - saturated fatty acids; MUFAs - monounsaturated fatty acids).
Autors, Rio de Janeiro - RJ. January-March, 2018.

Discussion

Less is known about the impact of BS on HM composition. The present case study showed that the average for some types of FAs in the HM of a nursing mother previously submitted to BS was different from those described in the non-operated population.

The composition of FAs in HM can originate from the de novo synthesis of FAs in the mammary gland, mobilized from maternal stores, i.e., adipose tissue, and supplied directly by maternal intake (diet and supplements) (Giufrida et al., 2022). Fatty acids with a chain length

greater than C14:0 originate from the maternal diet or body stores, while fatty acids up to C14:0 originate from de novo synthesis in the breast (Nasser et al., 2010).

Evaluating the SFAs, it was possible to observe higher averages for myristic fatty acid (C14:0), when compared with Brazilian studies performed by Freitas et al. (2019) and Nishimura et al. (2013), analyzing the HM, who found a content of 6.81% and 8.12%, respectively. de La Garza Puentes et al. (2019) found 5.15% in COL and 4.79% in MM of normal-weight and 5.38% (COL) and 4.67% (MM) in overweight women who did not undergo BS. The finding in our study is confirmed by information on food intake, reported by the nursing mother in consultation, of high amounts of whole milk and its derivatives, due to myristic acid being found in abundance in milk fat (Lottenberg, 2009) and having consumed low-fat foods.

According to Nasser et al. (2010), low-fat foods have this type of fatty acid. It is important to emphasize that the study by Noto et al. (2016) showed that C14:0 was correlated with a decrease in plasma HDL-C levels in a Mediterranean population. Furthermore, Almeida et al. (2020), comparing the types of BS, found higher consumption of C14:0 and C16:0 FAs by patients in the group that underwent RYGB. Wijayatunga et al. (2018), to evaluate alterations in the serum metabolites and fatty acids (FA) from 20 patients undergoing RYGB surgery at 2 weeks and 6 months after RYGB, observed that C14:0 significantly increased after RYGB at 6 months compared to pre-surgical concentrations.

In our study, higher averages for myristic fatty acid contents were observed followed by palmitic fatty acid (C16:0), in all stages of lactation. Castro et al. (2021) and Freitas et al. (2019) and Nishimura et al. (2013) found C16:0 as the highest concentration of SFA in nursing mothers who did not undergo BS. Analyzing C16:0 content, de La Garza Puentes et al. (2019) found values of 21.13% (COL) and 19.56 (MM) in the HM of women with adequate weight and 21.24% (COL) and 19.53% in overweight women.

Oleic acid (C18:1 n-9) was the most abundant of all monounsaturated fatty acids (MUFAs) and all studies FAs, as can be seen in other studies Castro et al. (2021) and Freitas et al. (2019) and Nishimura et al. (2013). It is noteworthy that Freitas et al. (2019) and Nishimura et al. (2013) evaluating the profile of this fatty acid in HM of nursing mothers with adequate weight, found higher means in the MM than the findings of the present study. The findings show that in addition to the FAs content in HM being able to change with the type of diet, maternal obesity (de La Garza Puentes et al., 2019) and malabsorption (Bordalo et al., 2011) can also contribute to this alteration. It is important to point out that the nursing mother in the study was still in weight loss due to performing the BS only two months before the beginning of the pregnancy and presenting a nutritional diagnosis of overweight.

Trans fatty acids vaccenic acid and elaidic acid have been detected in human milk, which is associated with the consumption of milk and dairy products (Aumeistere et al., 2021).

Trans MUFA contributed with the following values, in the present study, in the analyzed milk groups: 0.83% in COL, 0.49% in TM, and 0.53% in MM. The concentrations of elaidic and vaccenic acid in the MM were 0.01% for both, values much lower than those found in the study by Nishimura et al. (2013) [0.28% (elaidic) and 1.68% (vaccine)]. This finding may have occurred because the study participant received nutritional guidance during care at the nutrition/prenatal clinic.

Excessive consumption of trans FAs by mothers can affect the growth and development of newborns (Bordalo et al., 2011), causing potential negative effects on the metabolism of essential FAs through the inhibition of linoleic acid (LA) desaturation in arachidonic acid (AA) and alpha-linolenic acid (ALA) in docosahexaenoic acid (DHA) (Costa et al., 2011). Its high level of HM results from maternal consumption of milk, dairy products and industrialized foods (margarine, vegetable creams, bread, cookies, chips, pasta, ice cream, pastries, and cakes, among other foods) (Aumeistere et al., 2021; Costa et al., 2016).

In Brazil, the Resolution of the Collegiate Board (RDC) nº 360, of December 23, 2003, establishes that any food that presents a transFA content lower than or equal to 0.2g/portion and made it mandatory to declare the content of transFA per portion on the labels of all food products (Brasil, 2003).

Conclusions

High concentrations of myristic fatty acid were observed in the human milk of women in our study compared to the milk of mothers who did not undergo BC. Regarding the values found for monounsaturated and trans fatty acids with data from the literature, we identified lower levels in the HM in the present case.

A limitation of the present study was that it represents a case study. Thus, we cannot state that the composition of FAs found in this case report reflects the composition of FAs in the human milk of all women who underwent BS. More studies are needed to better assess the implication of BS in the composition of FAs in human milk.

Based on the results of the study, the importance of nutritional guidance during the pregnancy/lactation period is reinforced, to adopt healthy eating habits, mainly to reduce the consumption of foods rich in trans fatty acid, as they can affect newborn growth and development.

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