



ΣΧΟΛΗ ΘΕΤΙΚΩΝ ΕΠΙΣΤΗΜΩΝ ΚΑΙ ΤΕΧΝΟΛΟΓΙΑΣ
ΠΡΟΓΡΑΜΜΑ ΣΠΟΥΔΩΝ: «ΧΗΜΙΚΗ ΚΑΙ ΒΙΟΜΟΡΙΑΚΗ ΑΝΑΛΥΣΗ»

ΜΕΤΑΠΤΥΧΙΑΚΗ ΔΙΠΛΩΜΑΤΙΚΗ ΕΡΓΑΣΙΑ
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ΟΞΕΩΝ ΚΑΙ ΑΛΛΕΥΔΙΚΩΝ ΠΑΡΑΓΩΓΩΝ ΤΟΥΣ ΣΕ ΓΑΛΑΚΤΟΚΟΜΙΚΑ»**

ΑΝΑΣΤΑΣΙΑ-ΠΑΡΑΣΚΕΥΗ ΤΣΙΓΚΟΥ

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ΠΕΡΙΛΗΨΗ

Το γάλα αποτελεί την πληρέστερη διατροφή σε θρεπτικά συστατικά στη φύση. Είναι κύρια πηγή βιταμινών, ιχνοστοιχείων, λιπαρών κ.α. για τον οργανισμό. Το γάλα μπορεί να προέρχεται από τα γαλακτοπαραγωγά ζώα, τα φυτά από τους καρπούς τους και από τον άνθρωπο που αναφερόμαστε στο μητρικό γάλα. Από τα διάφορα είδη γάλακτος το πλουσιότερο σε λιπαρά οξέα και ειδικά σε πολυακόρεστα είναι το μητρικό. Η περιεκτικότητα των πολυακόρεστων λιπαρών οξέων στο γάλα σχετίζεται με την φυλή προέλευσης, με την περίοδο παραγωγής του (εποχή, τρίμηνο θηλασμού κ.α.) και κυρίως με την διατροφή. Μια διατροφή πλούσια σε πολυακόρεστα λιπαρά οξέα θα αυξήσει και τις συγκεντρώσεις αυτών στο παραγόμενο γάλα.

Τα λιπαρά οξέα αποτελούν κύρια πηγή θρεπτικών συστατικών και χωρίζονται σε δύο κατηγορίες, τα κορεσμένα και τα ακόρεστα. Τα ακόρεστα ωστόσο, κατηγοριοποιούνται σε μονοακόρεστα και πολυακόρεστα λιπαρά οξέα βάσει του αριθμού των διπλών δεσμών που φέρουν στο μόριο τους. Τα πολυακόρεστα χωρίζονται επιπλέον σε δύο υποκατηγορίες, στα ω -3 και ω -6. Ο διαχωρισμός αυτός για το μόρια των Π.Λ.Ο. βασίζεται στην απόσταση που έχει ο δεύτερος διπλός δεσμός από το μεθυλικό άκρο που φέρουν. Το κυριότερο μονοακόρεστο οξύ του συναντάμε στο γάλα είναι το ελαϊκό οξύ ενώ για τα πολυακόρεστα υψηλή περιεκτικότητα παρουσιάζουν το αραχιδονικό, το εικοσιδιεξανοϊκό, και το εικοσαπεντανοϊκό οξύ.

Οι συνήθεις τεχνικές που χρησιμοποιούνται για την ανάλυση αυτών των λιπαρών οξέων είναι η υγρή χρωματογραφία συζευγμένη με φασματομετρία μάζας, η αέρια χρωματογραφία με φασματομετρία μάζας και ο πυρηνικός μαγνητικός συντονισμός. Μεταξύ αυτών των τεχνικών μεγαλύτερη ευαισθησία παρουσιάζει η υγρή χρωματογραφία συζευγμένη με φασματοσκοπία μάζας και αποτελεί την μέθοδο που έχει μελετηθεί περισσότερο από τους επιστήμονες. Παρόλα αυτά, τα τελευταία χρόνια η τεχνική του πυρηνικού μαγνητικού συντονισμού αποτελεί κι αυτή μία καλή επιλογή για την ανάλυση διότι προσφέρει αξιοπιστία αποτελεσμάτων καθώς δεν είναι καταστρεπτική για το δείγμα, επιτρέποντα έτσι πολλαπλές επαναλήψεις στην διαδικασία ανάλυσης.

Οι τεχνικές αυτές χρησιμοποιούνται σε συνδυασμό με έναν μηχανισμό μετατροπής των λιπαρών οξέων με σκοπό των ευκολότερο προσδιορισμό τους με σύγχρονες τεχνικές ανάλυσης, στο γάλα και στα προϊόντα του. Ο μηχανισμός αυτός βασίζεται στην υπεροξείδωση των ομάδων μεθυλενίου προς σχηματισμό ελεύθερων ριζών. Στη συνέχεια, οι ρίζες αυτές αντιδρούν με το μοριακό οξυγόνο κι έχει ως τελικό αποτέλεσμα την παραγωγή αλδεϋδικών προϊόντων. Πέραν της μέτρησης των προϊόντων οξείδωσης, η παραγωγοποίηση του γάλακτος για των προσδιορισμό των πολυακόρεστων λιπαρών οξέων αποτελεί και την κύρια μέθοδο προσδιορισμού τους.

Τα συμπεράσματα που απορρέουν από την ανασκόπηση των άρθρων της βιβλιογραφίας είναι πως η περιεκτικότητα των πολυακόρεστων λιπαρών οξέων τόσο

για τον άνθρωπο όσο και για τα ζώα σχετίζονται κυρίως με την προέλευση και την διατροφή τους. Το παραγόμενο μητρικό γάλα είναι πλουσιότερο σε πολυακόρεστα λιπαρά οξέα από το ζωϊκό και τα προϊόντα του γάλακτος όπως, το τυρί και το βούτυρο είναι πλουσιότερα συγκριτικά με το γάλα από το οποίο παρασκευάζονται. Αυτό οφείλεται στην παραγωγική διαδικασία και την πρώτη ύλη που χρησιμοποιείται, δηλαδή το ανώτερο στρώμα του γάλακτος που περιέχει την υψηλότερη συγκέντρωση σε λιπαρά οξέα.

ABSTRACT

Milk is the most complete diet in nutrients in nature. It is the main source of vitamins, trace elements, fats, etc. for the organization. Milk can come from dairy animals, plants from their fruits and from humans we refer to breast milk. Of the various types of milk, the richest in fatty acids, and especially in polyunsaturated ones, is mother's milk. The content of polyunsaturated fatty acids in milk is related to the breed of origin, to the period of its production (season, trimester of breastfeeding, etc.) and mainly to diet. A diet rich in polyunsaturated fatty acids will also increase the concentrations of these in the milk produced.

Fatty acids are a major source of nutrients and are divided into two categories, saturated and unsaturated. Unsaturated, however, are categorized into monounsaturated and polyunsaturated based on the number of double bonds they carry in their molecule. Polyunsaturated are further divided into two subcategories, ω -3 and ω -6. This separation for the molecules of pufa is based on the distance of the second double bond from the methyl end they bear. The main monounsaturated acid found in milk is oleic acid, while the polyunsaturated ones are high in arachidonic, docosahexaenoic, and eicosapentaenoic acids.

Common techniques used to analyze these fatty acids are liquid chromatography coupled to mass spectrometry, gas chromatography with mass spectrometry, and nuclear magnetic resonance. Among these techniques, liquid chromatography coupled with mass spectroscopy shows greater sensitivity and is the method that has been studied the most by scientists. Nevertheless, in recent years the nuclear magnetic resonance technique is also a good choice for the analysis because it offers reliability of results as it is not destructive to the sample, thus allowing multiple repetitions in the analysis process.

These techniques are used in conjunction with a mechanism for converting fatty acids in order to make them easier to determine with modern analytical techniques, in milk and its products. This mechanism is based on the peroxidation of methylene groups to form free radicals. Subsequently, these radicals react with oxygen and the final result is the production of aldehyde products. In addition to the measurement of oxidation products, the production of milk for the determination of polyunsaturated fatty acids is also the main method for their determination.

The conclusions derived from the review of the literature articles are that the content of polyunsaturated fatty acids for both humans and animals is mainly related to their origin and diet. Produced breast milk is richer in polyunsaturated fatty acids than animal milk and milk products such as cheese and butter are richer compared to the milk from which they are made. This is due to the production process and the raw material used, i.e. the upper layer of the milk which contains the highest concentration of fatty acids.

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