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Leptin modulates fat taste perception in taste papillae

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Biography

Hameed Ullah is PhD student at the Department of Physiology, Nutrition and Cancer, University of Burgundy Dijon France. He is doing research on taste perception specifically

on the taste for fat under the team of NuTOX. This group is committed to 6th taste modality i.e. taste for fat in the microenvironment of taste bud cells. The group has identified the fat taste receptors in tongue papillae of mice. The discovery of fat taste receptors CD36 and GPR120 in taste tissue open a new debate on this new taste modality. Currently I am perusing my last year of research with this group under the title " Role of leptin in the modulation of preference for fat in mice". We have identified for the first time that fat taste receptors co-expressed with leptin receptors in mice taste bud cells. This means that fat eating behaviour might be control from the very beginning of food episode independent of brain gut axis.

Abstract

The prevalence of overweightness and obesity is on the rise throughout the world. Current researches have successfully unveiled, the existence of a gustatory cue, i.e., taste for fat. This gustatory perception might result into overeating behavior. In this study, we used biochemical and behavioral approaches to explore the role of leptin, an anorectic peptide that controls eating behaviour, energy homeostasis and body weight via its action on different areas in the brain of mice. We used the two-bottle preference and licking tests to assess the fat taste perception in mice. Confocal microscopy was used to demonstrate the colocalization of fat taste receptors (CD36 and GPR120) with leptin receptor in mice taste bud cells (TBCs). To explore the role of leptin in the oro-sensory perception of dietary fatty acids, we used RT-qPCR, calcium signaling, ELISA, membrane potential and western-blotting techniques. We conducted experiments on isolated TBC (ex-vivo studies) or on different mice models like genetically modified obese (ob/ob) or diet-induced obese (DIO) mice (in vivo studies) in order to explore the implication of leptin in the modulation of oro-sensory perception of dietary long-chain fatty acids. The in-vitro studies on cultured TBC show that leptin, released from these cells into the micro-environment of papillae of the tongue, modulates fat preference in wild type mice. Leptin suppressed the dietary fatty acid in these mice but surprisingly, administration of exogenous leptin increased fat taste sensitivity in ob/ob mice. The DIO mice, leptin shows no significant response which might be due to leptin resistance. Our results shows for the first time that leptin receptors are co-expressed with fat taste receptors in TBC and may control fat eating behaviour via its local action, probably in an autocrine manner, in the taste papillae, and also via its peripheral action. Finally, we can say that leptin might control preference for fat at different levels by modulating the sensitivity of fat taste. The increase in sensitivity to fatty acids solutions decrease the intake of fat/lipids which might reduce the incidence of overweight and obesity in mice.

Key words:
CD36; obesity; fat taste

Importance of Research: Obesity is considered a multifactorial cosmopolitan medical condition associated with several other critical health complications. In 2003, the World Health Organization (WHO) reported that more than one billion people on this planet were overweight, of which nearly 800 million were clinically obese. The situation of obesity is predominantly the result of the accumulation of high fat, due to an imbalance of energy intake and energy expenditure.

The sense of taste informs the organism about the quality of ingested food. There are, so far identified, five basic taste qualities, i.e., sweet, sour, bitter, salty and umami. Recent compelling evidence from rodent and human studies raises the possibility for an additional 6th taste quality, devoted to the perception of dietary fat. Hence, two principal glycoproteins, CD36 and GPR120, are involved in fat taste perception. The CD36 is a scavenger receptor, whereas GPR120 is a GPCR and belongs to seven trans-membrane domain receptors family. The implication of CD36 in the gustatory perception of fat was shown by employing the double-choice test. The experiments on wild type and CD36 knock-out mice demonstrated that the latter animals completely failed to exhibit the preference for dietary fatty acids. We have shown that CD36 and GPR120 act in a synergic and complementary fashion to control fat eating behaviour.

Leptin, the product of ob (obese) gene, is produced by the adipose tissues and other organs. Leptin promotes weight loss, by stimulating the rate of metabolism and suppressing appetite. Leptin also signals on the nutritional status to several other physiological systems and modulates their functions. The defect in ob gene contributes to suppressed leptin production and, ultimately, causes diabetes and development of severe obesity.

Several factors have been shown to influence fat intake and the control of food behaviour. The hormone/peptides released by gut during post-prandial phase of food intake trigger satiation. The agents like glucagon-like peptide-1 (GLP-1), cholecystokinin (CCK), neuropeptide-Y (NPY), pancreatic polypeptide, and ghrelin modulate food ingestion. Leptin and insulin signal the adiposity in both short and long-term energy balance homeostasis. It is interesting to mention that these gut-derived peptides/hormones have a short half-life, and they are rapidly degraded during food episode. Hence, several recent studies have demonstrated that taste buds also release a number of these peptides/hormones including leptin and CCK and control oro-cephalic phase of food intake. Leptin is a very interesting hormone as it is released not only by epithelial cells of the stomach but also by lingual papillae in the vicinity of taste bud cells. However, no study is available on the role of leptin, particularly that released by taste papillae, in the modulation of dietary fat intake. In this study, we propose to assess the implication of tongue leptin in the orosensory perception of a dietary long-chain fatty acid in mice.

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Title: Nutritional aspects of Autism Spectrum Disorder – case study of the role of folate

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Biography

Dr. George Ayoub is an educator and health scientist with research in three areas: glaucoma, where he identified herbal medicines that help protect vision; cancer, where he has identified foods that stop the growth of cancer cells; and mental health, where he seeks to reduce symptoms of autism and mood disorders related to nutritional deficits. He has taught 10,000 students over the past 25 years in biological, psychological and medical disciplines. He regularly speaks on contemporary issues regarding body, health and nutrition and is the author of 8 books on health and nutrition, including health guides for community clinic patients: Yo Saludable and To Your Health, both published in 2020.

Abstract

Autism spectrum disorder (ASD) is a developmental disability that can create significant behavioral and communication challenges. The prevalence of ASD among children at 8 years of age is approximately 2%, and the prevalence is similar across ethnic groups. Studies have shown that the majority of ASD children make an antibody to the high-affinity folate receptor in response to a dietary component. This folate receptor antibody (FRA) blocks transport of folate across the blood-brain barrier (BBB), resulting in a cerebral folate deficiency (CFD). In clinical trials, these ASD children had improvement in their communication when placed on a daily supplement of folate in its reduced form, which can enter the brain via a low-affinity transport.

We here report that nutritional modification combined with psychotherapy of ASD children can partially overcome this CFD, reducing ASD symptoms in our study. Our studies indicate that nutritional treatment of CFD with reduced folate in children at the earliest stages may be most productive in limiting long-term ASD symptoms.

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Title: Effect of Bodypump Exercise On Adiponectin Serum Level Among Sedentary Obese Female

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Biography

Elham Ahmadi is a lecturer at the university and has participated in two research projects and has coached for several years as a coach in sports medicine clubs and is currently working on a new research project.

Abstract

The prevalence of obesity and its complications is rapidly increasing worldwide. Bodypump was created as a muscular endurance workout based on scientific research. The purpose of the present study was to determine of bodypump exercise effect on adiponectin serum level in sedentary obese females. First of all randomly selected 22 untrained females with average age 25.36±7.50 years old, weight 91.15±13.12 kg, height 164.09±5.92 cm and body mass index (BMI) 33.95±5.95 kg/m² (experimental group) and 20 untrained females with average age 30.63 ±6.39 years old, weight 85.35±10.65 kg, height 163.55±5.72 cm and body mass index (BMI) 31.92±2.95 kg/m² (control group) who had no exercise training in last one year. The study method was semi-experimental research. In this study experimental group done bodypump training with a progressive resistance training protocol (included 8 resistance training, 3 sessions per week, for totally 6 weeks) and the control group did not any training during protocol training time. Blood samples were collected after 12- 14 hour fasting in the same conditions at the beginning of program and at the end of 6th week of performance (per- test and post- test sample). Pre- test and post- test serum adiponectin values were measured. We used kolmogorov-smirnov statistical tests to analyze the results and dependent t- test to comparison of pre- test and post- test variables. The all calculations were accomplished by SPSS software, version.19. The results indicated that the body pump training on adiponectin volume in experimental group had no significant difference($p \leq 0.05$).

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Title: Novel Tocopherol-loaded Nanoemulsion for Enhanced Biodispersibility: Safety Food Delivery-System

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University Tsukuba, Japan

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Biography

Dr. Sana Yakoubi holds a PhD in Biological sciences on the topic of "Novel nanometric delivery system development for active substances for enhanced bioavailability". Her

Master researchs in Biochemistry focused on the "Inflammation Modulation by Macrovipera lebetina venom-derived C-type lectins". She conducted several works on Innovation Medical Research Institute Japan (IMRI), Division of Food Engineering, Food Research Institute, (NARO), Graduate School of Life and Environmental Sciences, University of Tsukuba, University of Medicine and Pharmacy, Aix-Marseille, IHU Méditerranée Infection and Faculty of Science of Tunis University of Tunis El Manar. She authored different papers in peer-reviewed international journals and has several communications in scientific meetings and international conferences.

Abstract

Statement of the Problem: A great attention has been received in the last decade for nanotechnology applications in food as well as in pharmaceutical industries. Bioactive substances-loaded Nanoemulsion is designed to improve their low bioavailability within the host, masks their unpleasant flavor, expands the application range, and increases overall acceptability. Therefore, it is necessary to use good emulsifiers to improve its physical stability and to reduce the interfacial tension between the two immiscible phases. This enables the formation of small droplet during homogenization, reflecting an obvious enhancement of the emulsion's physical stability. Thus, the main goal was the development of stable nanometric delivery system, of interest prolonged release in in food industry (functional food, additives ingredients, ...) and / or drug delivery system (dietary supplement, nutraceutical formulation, active targeted administration, ...). Methodology & Theoretical Orientation: The effect of the interaction between Gum Arabic (GA) and Tween 80 (T80) at different ratios on the droplet size diameter (d3.2) and interfacial tension (IFT) of tocopherol based nanoemulsions (TO-NE) has also been investigated. Findings: The physical parameters measurements showed that when T80 interacted with GA at ratio (0.75: 0.25 v/v) into the aqueous phase, it synergistically reduced the d3.2 and IFT to 106 nm and 11.3 mN/m respectively. A follow-up study of stability examined the stabilizing mechanism of the NE, showing a good stability against ionic strength up to 500 mM of NaCl, for all-range of temperature values and over time in 4 °C, neutral pH and without salt addition showing a nanometer-sized droplets. We postulate a competitive adsorption of T80 and GA at the oil-water interface. Conclusion & Significance: The microencapsulation by emulsion offers an effective way to protect microbes in adverse in vitro and in vivo conditions reflecting a promising approach for the large-scale production of microencapsulation with potential application in various fields encompassing, agriculture, food, pharmaceutical and biomedical industries