Doctoral school
- doctoral thesis summary-

Title: The influence of macronutrient intake on child nutritional status
PhD supervisor: Prof.dr. Mărginean Oana Cristina
PhD student: Hadmaș (Martin-Hadmaș) Roxana Maria

Introduction: The association between nutritional intake and health status has been frequently used as a research hypothesis in various papers which studied the rate of obesity. Most research has been conducted on adult participants. The number of papers that focused on the role of energy and nutrient intake in pediatric patients is limited, a reason why the current dietary recommendations are incomplete and contradictory in the literature.

Study hypothesis: An increased intake of carbohydrates and fats, respectively decreased protein and micronutrients intake can selectively influence the anthropometric or motor development of the child which can therefore increase the inflammatory markers.

Objectives: The main objective of this research is to study immunological and metabolic markers which provide information regarding children nutritional status and the necessary nutritional measures to support balanced anthropometric development.

1**.** The purpose of the first study was to analyze caloric and macronutrient intake compared to the needs of a healthy child and its influences on physical development,

2. The second study aimed to assess the intake of dietary lipids, minerals, and vitamins in association with stature-weight development,

3. The third study aimed to assess the main changes in anthropometric development and inflammatory markers due to food intake,

4. The fourth study aimed to correlate inflammatory markers (IL-6, IL-8), with other biochemical parameters, stature-weight development, and nutrient intake.

General methodology: The research was conducted over 24 months, January 2019 - January 2021, on a sample of 447 healthy participants, aged between 3 and 12 years.

Functional explorations consisted of anthropometric measurements next to the resting metabolic rate, following an indirect calorimetry methodology. Along with these functional explorations, we measured serum IL-6, IL-8, total serum proteins, cholesterol, and serum triglycerides. The food intake of each participant was analyzed and reported by using a food diary that allowed the determination of energy, macronutrients, and micronutrients intake.

Results:

Study 1 - The underweight ($p = 0.0013$), normal-weight ($p = 0.0048$) and obese ($p = 0.0001$) study samples had higher protein intake compared to the theoretical requirements. A deficit was

observed in all three study groups regarding carbohydrate intake (p = 0.0001), while fat intake was lower than the recommended amount in the underweight (p = 0.0001) and normal-weight samples (p = 0.0001), but higher in the obese study group (p = 0.0001). Body weight was significantly correlated with vitamin E intake, without correlating with the intake of fat, protein or carbohydrate. In the underweight study group, body weight was positively correlated with the protein (p = 0.0001), fat (p = 0.01), calcium (p = 0.003) and sodium (p = 0.005) intake; body height was positively correlated with the intake of protein (p = 0.004), fat (p = 0.01) and calcium (p = 0.04).

Study 2- The fat intake was statistically different between the study groups (p = 0.0009), being higher in the obese study group compared to the underweight and normal-weight study groups. The intake of saturated fats (p = 0.0001), polyunsaturated (p = 0.0001) and trans fats (p = 0.0001) was higher in the obese individuals. The intake of monounsaturated fats was higher in the underweight sample than in the normal-weight sample but lower than in the obese study sample (p = 0.0001). Saturated fat intake was positively and statistically significantly correlated with the main anthropometric measurements, including the body weight (p = 0.0001), the height (p = 0.001), and the BMI (p = 0.001). Both dietary cholesterol intake (p = 0.018) and saturated fat intake (p = 0.01) were positively correlated with the body weight. The intake of monounsaturated fats was positively correlated with both stature and weight. The intake of vitamins B1, B6, B12 was positively associated with the intake of monounsaturated and polyunsaturated fats.

Study 3- The sum of skinfolds was positively correlated with BMI (p = 0.0001), weight for age (p = 0.0001) and height percentile for age (p = 0.0069). Diastolic blood pressure was positively correlated with body weight (p = 0.0001), while the percentage of active body mass was negatively correlated with the skin folds value (p = 0.0001). Changes in skin folds were statistically correlated with total serum proteins (p = 0.019) and serum triglycerides (p = 0.015). Weight percentage by age (p = 0.0001), height percentile by age (p = 0.006) and active body mass (p = 0.0069) were positively correlated with the sum of skin folds. IL-8 value failed to correlate with the main anthropometric measurement results (p>0.05). Serum cholesterol was negatively correlated with O_2 consumption during the basal metabolic rate measurement (p = 0.0019) and positively correlated with the respiratory exchange ratio (RQ) (p = 0.013). However, IL-8 was positively correlated with RQ value (p = 0.0211) and negatively correlated with fat metabolism (p = 0.0042).

Study 4- IL-6 value was negatively correlated with daily fiber intake (p = 0.0005), while daily sugar intake was positively correlated with changes in serum parameters (p = 0.0186). Vitamin A intake (p = 0.0489), Vitamin C (p = 0.0181) and Vitamin B1 (p = 0.0064) were negatively correlated with serum IL-6. Macronutrient intake failed to correlate with serum IL-8 concentration, while calcium intake was statistically correlated (p = 0.0389).

General conclusions: In the study sample aged 3 to 5 years, body weight was insensitive to macronutrient intake. Inflammatory markers were not related to the bodyweight but to the skin fold value, which may indirectly be correlated with body fat mass.

The originality of the thesis: The results of this paper bring new information, according to which the inflammatory status becomes insensitive to changes in body weight but sensitive to changes in body mass, by increasing fat mass and limiting active body mass development. The result is opposite to those published in the literature, which suggests that any change in body weight will be a risk factor and implicitly a mediator that will trigger the secretion of pro-inflammatory markers with numerous manifestations and clinical consequences.