EFFECT OF HONEY SUPPLEMENTATION ON GUT MICROBIOTA IN MALNOURISHED CHILDREN

Thesis

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✍ *Walaa Ateya Ghanem*

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List of Abbreviations

Abbr.	Full-term
ATP	*Adenosine triphosphate*
BBB	*Blood brain barrier*
BCM	*Body cell mass*
BL	*Body length measurement*
BMI	*Body mass index*
BW	*Body weight measurement*
CH5	*50% hemolytic complement activity*
FFM	*Fat free mass*
FOS	*Fructo-oligosaccharides*
FOXO1	*Fork head box O1*
GET	*Gastric emptying time*
GH	*Growth hormone*
HAZ	*Z score Height for age*
HDL	*High-density lipoprotein*
HO-1	*Heme oxygenase-1*
ICV	*Intra cerebroventricular*
IDD	*Iodine deficiency disorders*
IGF-	*Insulin-like growth factor*
IGF1	*Insulin-like growth factor 1*
IGFBP3	*Insulin' like growth factor-binding protein-3*
IL-6	*Interleukin 6*
iNOS	*Nitric oxide synthase*
IQR	*Inter-quartile range*
K+	*Potassium*
LDL	*Low-density lipoprotein*
LPS	*Lipopolysaccharide*
MAZ	*Z-score mid arm circumference*
MUAC	*Mid arm circumference*
NF-κB	*Nuclear factor-kappaB*
NO	*Nitric oxide*
NPY	*Neuropeptide Y*

Ob ..... *Obese*
ORAC ..... *Oxygen radical absorbance capacity*
P13K ..... *Phosphatidylinositol 3-kinase*
PEM ..... *Protein energy malnutrition*
PEM ..... *Protein energy malnutrition*
POMC ..... *Pro-opiomelanocortin*
RNIs ..... *Reactive nitrogen intermediates*
ROIs ..... *Reactive oxygen intermediates*
S6K1 ..... *S6 Kinase 1*
SAM ..... *Severe acute malnutrition*
SD ..... *Standard deviation*
SD ..... *Standard deviations*
SOD ..... *Superoxide dismutase enzyme*
SPSS ..... Statistical Package for Social Science
TC ..... *Total cholesterol*
TG ..... *Triglycerides*
TNF-α ..... *Tumor necrosis factor-α*
UMF ..... *Unique Manuka Factor*
WAZ ..... *Z score weight for age*
WHZ ..... *Z-score weight for Height*

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Abstract

Background: Malnutrition in children is a global public health problem with wide implications. Malnourished children have increased risk of dying from infectious diseases, and it is estimated that malnutrition is the underlying cause of 45% of global deaths in children below 5 years of age. Prebiotic effect of honey has been observed in several monofloral honeys one of them is clover honey which used in this study. Honey is a prebiotic, containing non-digestible oligosaccharides and is Bifidogenic factor.

Aim of the Work: evaluating the role of honey supplementation (Egyptian clover honey) as a prebiotic on gut microbiota of malnourished children aged of 6 months to 3 years old.

Patients and Methods: This randomized single blinded case control prospective interventional study was conducted on forty infants and children of both sexes, aged 6 months to 3 years, with malnutrition recruited from the Nutrition Clinic of children Hospital, Ain Shams University, Egypt. The grading of malnutrition was based on WHO Z-Scores. Patients were randomly assigned following a simple randomization procedure (computerized random numbers) to malnourished children before honey intake group (group 1) and malnourished children after honey intake for 2 months (group 2). Each group consisted of 20 patients. An additional 20 healthy infants and children of matched age, sex and residency were recruited as a healthy control group (group 3).

Results: After honey intervention for 2 months There was a high statistically significant difference in (group 2) compared with the malnourished group (group 1) : increase in log count of Lactobacillus and Bifidolongum with p-value 0.000,increase in anthropometric measurements , WAZ, HAZ, MAZ and mid-arm circumference and height with p-value = 0.001 and 0.000 respectively. An increase was observed in the total caloric intake with p-value =0.000; decrease in the frequency of infection with p-value =0.000 and. However, there were non statistically significant differences in weight and WHZ in (group 2) in comparison with (group 1) with p value =0.930 and 0.620 respectively.

Conclusion: Honey consumption in a group of malnourished children resulted in positive effects: increased gut. microbiota (Lactobacillus and Bifidobacteria), decreased frequency of infections, Improved appetite with subsequent increase of total caloric intake and weight gain.

Key words: Honey Supplementation, Gut Microbiota, Malnourished Children

Introduction

Malnutrition is the leading cause of death worldwide in children under the age of five, and accounts for deaths between one and six million children every year. It is also the focus of the first Millennium Development Goal ***(Million et al., 2016).***

Malnutrition is a significant pediatric health problem worldwide, resulting in nearly half (45%) of all deaths (about 3.1 million) in children less than 5 years. Those who survive frequently suffer from long term sequelae including growth failure and neurodevelopment impairment ***(Kane et al., 2015).***

Malnutrition can be defined as inadequate nutrition ranging from under to over nutrition ***(Million et al., 2016).***

The World Health Organization (WHO) defines malnutrition as "the cellular imbalance between the supply of nutrients and energy and the body's demand for them to ensure growth, maintenance, and specific functions." This dynamic imbalance of nutrients affects children differently than adults and can have profound implications for the developing child ***(Mehta et al., 2013).***

Under nutrition includes deficiency in macronutrients (protein, global energy) or micronutrients (metals such as zinc, selenium, or vitamins). Although stunting rates are