LETTER TO THE EDITOR

MEDITERRANEAN DIET AND PHYSICAL ACTIVITY IMPROVE POSTURE, FAT MASS AND SALIVARY pH

R.G. BELLOMO[1], D. TRIPODI[2], C. BOSNA[2], S. D'ERCOLE[2], G. BARASSI[2], A. PORRECA[3], R. VERALDI[2], L. PROSPERI[2], C. BARBATO[2] and R. SAGGINI[2]

[1]Department of Biomolecular Sciences, "Carlo Bo" University, Urbino, Italy; [2]Department of Medical Oral and Biotechnological Sciences, "Gabriele d'Annunzio" University, Chieti-Pescara, Italy; [3]Department of Economics, "Gabriele d'Annunzio" University, Chieti-Pescara, Italy

Received April 24, 2018 – Accepted July 27, 2018

Many researchers have revealed that diet and physical activity influence metabolic function and posture in various stages of life. This paper aims to combine them and demonstrate how they could promote a healthy lifestyle. For this purpose, 14 healthy subjects followed a three-month protocol combining physical activity with dietary advice. At the end of the protocol, the results of the study underlined a significant reduction in fat mass, an improvement in salivary pH, and a realignment and rebalancing of body segments.

To the Editor,

Non-communicable diseases, such as diabetes and cardiovascular diseases, are highly related to modifiable risk factors such as improper diet and a sedentary lifestyle. Although these diseases often occur only in adulthood, they are usually initiated during adolescence. For this reason, the dietary habits of young people, their frequency of physical activity and other factors are crucial for an appropriate lifestyle. Moreover, an unhealthy diet is often associated with sedentary activities that lower energy consumption; for these reasons, there is a close correlation between the development of disorders in adulthood and an improper diet during adolescence (1). Several studies have already assessed the effects of physical exercise on metabolic variables; therefore, the quality and intensity of exercise are a fundamental target for pursuing proper results (2). This paper aims to combine aerobic training-based physical activity aimed to restore proprioception, rebalance posture and body homeostasis with food advice (in this study, the Mediterranean diet was selected) and demonstrate how this combination can improve posture, body composition parameters and salivary pH in a population of young people. At the Physical and Rehabilitation Medicine Centre and in collaboration with the Department of Oral Medical and Biotechnological Sciences of the "G. d'Annunzio" University of Chieti-Pescara, a three-month protocol was planned. For this purpose, 14 healthy subjects were enrolled. All participants gave written informed consent to the experimental procedure, which was in accordance with the latest revision of the Declaration of Helsinki and the procedures defined by the ISO 9OO1 standards for "Research and Experimentation"; the procedure also protects the privacy of subjects participating in biomedical research.

The inclusion criteria were healthy subjects aged between 18 and 26 years, who had never

Key words: physical activity, posture, Mediterranean diet, salivary pH

Mailing address:
Dr Giovanni Barassi,
Department of Medical Oral
and Biotechnological Sciences, "Gabriele d'Annunzio" University,
Chieti-Pescara, Viale Abruzzo 322, 66100 Chieti, Italy
Tel.: +39 0871 3553009
e-mail: coordftgb@unich.it

0393-974X (2018)

practised sports at a competitive level, no trauma in the previous 12 months and eligibility for physical activity. The exclusion criteria were current use of pharmacological therapy, chronic or acute pathologies, and surgical intervention in the previous 12 months.

The sample was evaluated at baseline (T0), at the end of the three-month period, immediately after the last training session (T1), and at follow-up (T2) one month after T1. The final evaluation aimed to assess the possible long-term effects of the protocol. At the three evaluation points, saliva was collected with Salivette® (Sarstedt AG & Co., Germany) (3). Specifically, the patients chewed the Salivette® cotton roll for 1 min which was then placed in a test tube and centrifuged. Saliva was also placed at the bottom of a second test tube, and the pH was measured using a pH meter (Elettrofor XS Instruments, Borsea, Italy). Saliva is a useful diagnostic tool to evaluate the state of health of the oropharyngeal cavity and contains many analytes linked with physiological and pathological conditions due to stress (4).

Posture was assessed by the Rarog system (software created and developed to improve the capability and precision of the Kinect®, which allows a static postural evaluation of subjects in a few seconds) (5), taking into account the variation in the position of the shoulders and pelvis in the frontal plane. The body composition was studied through the percentage variation in fat mass (FM), using the BIA system. The participants performed physical activity combining resistance and aerobic exercise: 10 min of warm-up phase on a cyclette; 20 min of an aerobic phase performed on a treadmill; 15 min of proprioceptive rehabilitation and balance training using a multi-sensory protocol of the I-Moove® system, a motor platform with elliptic oscillatory movements and visual feedback for the requested task (6); 10 min of lower limb muscle functional stretching and 5 min of cool down.

The study participants did not receive dietary supervision or personalized food advice and ate according to the Mediterranean diet pyramid by consuming cereals, fruits and vegetables, legumes, olive oil, low-fat cheese and yogurt every day; fish and eggs weekly; and meat once per month.

Outcome variables and statistical analysis

Fat mass (FM) was measured as a percentage of the body weight (Kg). Ph of saliva was assessed through the variable PH; a normal value of pH is 7±0.25. Position of shoulders, is represented by SH variable, which expresses the grade distance from the ideal value of a correct posture of shoulders: 0°. Position of the hip bone is assessed in grade by SB variable; it expresses the values distance from the ideal angle: 0°. Descriptive statistics were used to describe the sample. To determine how the sample changed over time: from T0 to T1 and T2, an ANOVA (within) on the variables was performed to evaluate how physical activity modified FM in patients and to understand how diet suggestions influenced the stimulated pH of the oral-pharyngeal cavity. The level for significance was set at $p<0.05$. All tests were performed using the R statistical software. Before carrying out the parametric analysis, normality was tested. The distribution of data for each variable at T0 was assessed for normality using the Shapiro-Wilks test. Because variables were normally distributed (tested at 95%), all data were analysed with parametric statistical tests.

RESULTS

The first evidence regarding FM, SB and PH is that the mean of sample decreased in the passage from T0 to T1 (Fig. 1) and this change was statistically significant only for FM and SB (Table I). Instead, FM did not vary in a statistical significantly way over time, while PH and SB changed in a statistically significant way in the passage from T0 to T1 and from T0 to T2 (Table I). The descriptive statistics (Table II) shows how PH decreased from a T0 value of 7.61 to a value of 7.51 and after 1 month without diet suggestions, it increased up to a value of 7.83. The mean of FM at T0 was 21.19% of the body weight; after 3 months of diet suggestions it decreased to 1.79% and at T2 it increased but less than the baseline value. The mean of SB at T0 was 1.39°, after 3 months it decreased to 1.04° and at T2 it decreased to 0.95°. Regarding SH (in mean) at the baseline the value was 2, after 3 months the position of shoulders was 2.22° in mean, but at T2 shoulders were far from the ideal value of 1.52°.

Table I. *ANOVA for repeated measures (within) and Post-hoc test.*

Variables	ANOVA	Post-hoc test		
	P-value	P-value		
		TIME 1 – TIME 0	TIME 2 – TIME 0	TIME 2 – TIME 1
FM	0.00574 **	0.00114 **	0.21023	0.14718
PH	0.000327 ***	0.28483	0.00521 **	< 1e-04 ***
SH	0.000792 ***	0.00386 **	< 0.001 ***	0.66579
SB	0.000972 ***	0.00396 **	0.00396 **	0.66581

*For each variable: Fat mass (FM), Ph of stimulated saliva (PH), Position of shoulders (SH) and Position of hip bone (SB) the significance level of p-value is : 0 '***' 0.001 '**'*

Table II. *Descriptive analysis of the sample.*

Variable	Mean ± SD	Range
AGE	20.43±0.94	19-22
FM0	21.19±7.69	9.64-41.25
FM1	17.59±5.24	7.94-28.11
FM2	19.48±6.39	8.38-28.77
SH0	2±0.49	1.23-3.2
SH1	2.22±0.74	1.6-3.6
SH2	1.52±0.66	0.81-3.4
SB0	1.39±0.67	0.69-2.6
SB1	1.04±0.6	0.3-2.6
SB2	0.95±0.66	0-2.5
PH0	7.61±0.22	7.16-7.88
PH1	7.51±0.32	7.03-7.98
PH2	7.83±0.17	7.55-8.21

Descriptive analysis were performed for age; fat mass (FM0, FM1, FM2); Ph of stimulated saliva (PH0,PH1,PH2); position of shoulders (SH0, SH1, SH2); position of the hip bone (SB0, SB1, SB2) at T0 , at the end of treatment and after 1 month from the end of the treatment, respectively.

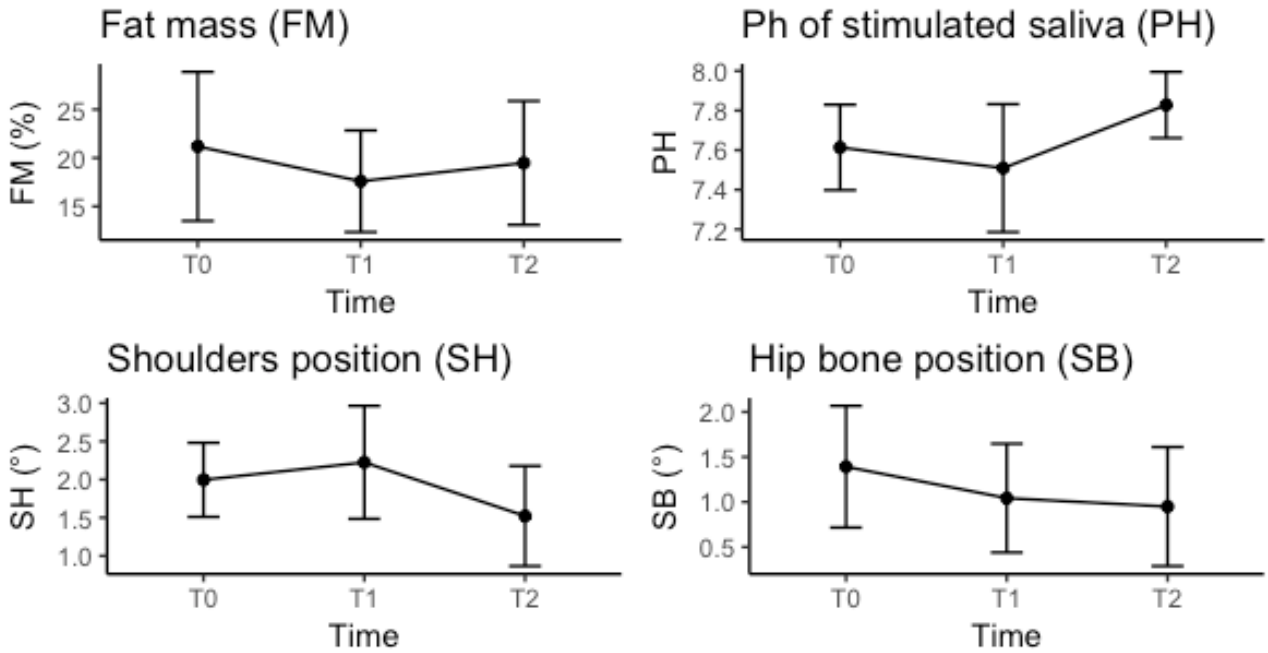

Fig. 1. *Change in average over time for each variable.*

DISCUSSION

Many studies suggested beneficial effects of combined programmes for the promotion of healthy eating habits and physical activity (7). Others have shown different techniques of somatic peripheral neuro-sensorial stimulation for posture modification and the consequent variation in body mass index; however, few studies have combined motor activity techniques on unstable platforms with proper nutrition in a young population (8, 9). Furthermore, the literature reports that a combination of interventions including nutrition, physical activity, knowledge, attitudes or behaviours related to health has the potential to reduce the risk factors associated with obesity (10). In fact, the efficacy of the aerobic training at reducing fat mass (FM) was clear in our results, which showed a statistically significant decrease (11). It is known that for health, background light physical activity and diet play a fundamental role and are key components for a high quality of life and contribute to weight loss and to a healthier oral cavity (12). The posture adaptations to physical activity require an adequate level of muscular strength to act against external forces and restore a given point of balance between various bone segments, such as the shoulders and pelvis (13). The I-Moove® instrumentation has contributed to improvement in posture, in particular the pelvic alignment (SB), confirming the benefits of proprioceptive training to rehabilitate posture and improve balance (14). A particularly notable change is the reduction in the difference from the ideal value (0°), with the difference changing from the T0 value of 1.39° to a value of 1.04° and then decreasing even further at the follow-up to 0.95°. Furthermore, this study shows how, by consuming a Mediterranean diet combined with correct aerobic exercise, the pH of saliva can be affected. Saliva is a specific parameter that, as demonstrated by Dodds (2005), suggests the general health of patient (15), and after treatment it changed from 7.61 at T0 to 7.51 at T1, so approaching to the normal value. In future, the sample size should be increased to confirm results shown in this pilot study and to verify general suggestions for proper nutrition and physical activity combination

in young people. In conclusion, we can state that a proper balanced diet and regular physical activity should be the baseline to try to maintain a proper level of biological and postural homeostasis. These parameters could be studied through variations in body composition, alteration of oral parameters and postural implications.

REFERENCES

1. Schaumberg K, Anderson D. Dietary restraint and weight loss as risk factors for eating pathology. Eat Behav 2016; 23:97-103.
2. Mello PB, Benetti F, Cammarota M, Izquierdo I. Effects of acute and chronic physical exercise and stress on different types of memory in rats. An. Acad. Bras. Ciênc. 2008; 80(2):301-9.
3. Park JR, Kim MH, Woo J, Lee SJ, Song KE. Measurement of amylase in saliva collected by salivette. Korean J Lab Med 2008; 28(6):438-43.
4. D'Ercole S, Tripodi D. The effect of swimming on oral ecological factors. J Biol Regul Homeost Agents 2013; 27(2):551-58.
5. Delli Pizzi S, Bellomo, RG, Carmignano S et al. Rehabilitation program based on sensorimotor recovery improves the static and dynamic balance and modifies the basal ganglia neurochemistry: A pilot 1H-MRS study on Parkinson's disease patients. Medicine 2017; 96(50):e8732.
6. Bellomo RG, Iodice P, Maffulli N, Maghradze T, Coco V, Saggini R. Muscle strength and balance training in sarcopenic elderly: a pilot study with randomized controlled trial. Int J Inflam 2013; 11(1):193-201.
7. Berkey CS, Rockett HR, Field AE, Gillman MW, Frazier AL, Camargo CA Jr, Colditz GA. Activity, dietary intake, and weight changes in a longitudinal study of preadolescent and adolescent boys and girls. Pediatrics 2000; 105:e56.
8. Barassi G, Bellomo RG, Di Giulio C, Giannuzzo G, Irace G, Barbato C, Saggini R. Effects of manual somatic stimulation on the autonomic nervous system and posture. Adv Exp Med Biol 2018; 1-13.
9. Barassi G, Bellomo RG, Di Iulio A, Lococo A, Porreca A, Di Felice PA, Saggini R. Preoperative rehabilitation in lung cancer patients: yoga approach. Adv Exp Med Biol 2018. Epub ahead of print.
10. Bellomo RG, Barassi G, Iodice P, Di Pancrazio L, Megna M, Saggini R. Visual sensory disability: rehabilitative treatment in an aquatic environment. Int J Immunopathol Pharmacol 2012; 25(1 Suppl):17S-21S.
11. Kesten JM, Griffiths PL, Cameron N. A systematic review to determine the effectiveness of interventions designed to prevent overweight and obesity in preadolescent girls. Obes Rev 2011; 12:997-1021.
12. Saggini R, Ancona E, Carmignano SM, Supplizi M, Barassi G, Bellomo RG. Effect of combined treatment with focused mechano-acoustic vibration and pharmacological therapy on bone mineral density and muscle strength in post-menopausal women. J Altern Complement Med 2017; 14(3):305.
13. Janssen, I, LeBlanc AG. Systematic review of the health benefits of physical activity and fitness in school-aged children and youth. Int J Behav Nutr Phys Act 2010; 7(1):40.
14. Hrysomallis C, Goodman C. A review of resistance exercise and posture realignment. J Strength Cond Res 2001; 15(3):385-90.
15. Dodds MW, Johnson DA, Yeh CK. Health benefits of saliva: a review. Int J Dent Oral Health 2005; 33(3):223-33.