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Impact of Physical Activities on the Physical Constitution of Female Farmers, Cyclists, and Traders in Makoua, Republic of Congo

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ABSTRACT

Introduction: Physical activity is an important determinant of health at all stages of life, but remains a modifiable behavior. Increasingly, fortifying people to exercise is an investment in human capital that can generate multiple benefits, both for individuals and for communities.

Aim/Objectives: The aim of this study was to assess the effects of physical activity on the body transformation of female farmer-cyclists and shopkeepers.

Method: The study involved 63 participants divided into two groups: 31 female farmer-cyclists and 32 female traders from Makoua's main market. Participants underwent an experiment assessing height, weight, body mass index and physical constitution variables before and after a 16-week period.

Results: Revealed an exponential difference in anthropometric and physical constitution variables in favour of farmer-cyclists, particularly in terms of weight, total fat mass and visceral fat mass. However, data relating to muscle mass and physical capacity were also in favour of farmer-cyclists.

Conclusion: Our results show that traders are more exposed to metabolic diseases. They should combine their commercial activities with physical activity, particularly cycling, to improve their body composition.

Key Words: Physical activities, Body composition Farmers, Traders, Women, Makoua

INTRODUCTION

Physical effort in humans is a factor which we consider important, and which has been the subject of much research in recent years. Today, it is considered the most important element in health management. Physical activity is an important determinant of health at all stages of life, but remains a modifiable behavior. Increasingly, fortifying people to exercise is an investment in human capital that can generate multiple benefits, both for individuals and for communities.[1]

Numerous studies show, among other things, that high levels of PA in young people are associated with better cardiovascular capacity and bone health, greater self-esteem.[2,3] On the other hand, insufficient effort or motricity corresponds to specific occupations whose energy expenditure is close to resting expenditure, such as watching TV or videos, reading. Indeed, time spent in front of a screen (television, video, video games, computer, etc.) is currently the most widely used indicator of a sedentary lifestyle. It is now recognized that physical effort and inactivity are two different and independent dimensions of movement behavior, associated respectively favorably and unfavorably with health status.[4] Indeed, physical activity is defined as any bodily movement produced by skeletal muscles resulting in energy expenditure.[5] Like a sedentary lifestyle, which the World Health Organization (WHO) classifies as the leading cause of mortality from non-communicable diseases after infectious diseases, physical activity is at the root of many diseases. It causes mortality, the risk of cardiovascular disease, diabetes and obesity, and effectively increases the risk of colon cancer, hypertension, osteoporosis, lipid disorders, depression and anxiety. According to the WHO, by 2024, 60-85% of the world's population, in both developed and developing countries, will have a sedentary lifestyle, making it one of the most serious public

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health problems of our era. Obesity will be the backdrop to this project, which will introduce physical activity as a therapy. Indeed, the rise of new technologies today is leading to a critical decline in physical activity, with machines replacing human tasks.[6]

We are also witnessing a shift away from sedentary activities such as shopping and simple household chores.[7] Lack of exercise is one of the main factors contributing to obesity.[8] This excess weight is a risk factor for the onset of chronic diseases such as cardiovascular and respiratory diseases, diabetes type 2, and certain forms of cancer by WHO 2010. In Congo, and more specifically in the Makoua locality, women use pedal or motorized bicycles as a means of transport for their various daily activities, such as going to the fields or to the market. Therefore, taking into account our theme "Impact of physical activities on body composition: women farmers-cyclists merchants of Makoua". It is in this perspective that we pose the fundamental question in terms of a problematic summarized as follows: what is the impact of physical activities on the physical constitution of women Farmers-cyclists and traders?

To answer this question, we formulated the following hypothesis: physical activity in women farmers-cyclists induces greater physiological adaptations on body composition than in women shopkeepers. The aim of this study was to assess the effects of physical activity on body composition in women farmers and shopkeepers. The subsidiary objectives were to compare the body composition variables of women farmers-cyclists and shopkeepers on the one hand, and to compare the anthropometric parameters of women farmers-cyclists and shopkeepers on the other. The aim and interest of this study is to show the importance of physical activity, to stigmatize sedentariness, which is one of the factors triggering non-transmissible diseases such as: arterial hypertension, cancer, diabetes, it reduces symptoms of depression and anxiety.

METHODOLOGY

Field of investigation and subjects

We conducted our study in the Congo, specifically in the Makoua autonomous district in the Cuvette Department. The choice of this location is explained by the fact that this district has significant arable land for farming activities and on the diversity of axes for a large number of women using bicycles as a means of transport. The population of this study was broken down in the table below.

Table 1: Distribution of Subjects into Target Population and Sample

Subjects Population Sample	Subjects Population Sample	Subjects Population Sample
Women cycling farmers	78	31
Women traders	62	32
Total	140	63

Source: ALONGO et al., 2024

The subjects included in our sample were those in normal physical and moral health, certified by the Makoua hospital medical center and officially recognized as market vendors by the market committee. They were selected from among test participants, based on criteria such as regular attendance at the market during the three months of activity. The subjects excluded from our sample were those who failed to attend one of the study tests.

Experimental procedure

Experiment brought on 63 subjects were randomized into two groups: Female farmer-cyclists and female shopkeepers. A session of familiarization with the instruments, according to the orientations. Experimentation began with measurements of anthropometric parameters (age, height, weight). The experiment began with a tug-of-war test linked to the pedometer device, which enables the following variables to be assessed: body fat (BF), body lean (LB), BMI and physical condition. This test is performed before and after four months.

Table 2: Daily Activity Schedules for Women Farmers versus Women Shopkeepers

Spot time 2min and break 20 to 25 seconds on average *vs* 30 seconds on average
Manual: 6 km average of 45 km average *vs*. outward journey on foot and sometimes on motorcycle and back
Break: 30 to 45 minutes *vs*. 10
to 15 min
Work volume: 12h/24h on average *vs* 10h/24h on average
Series without rest: 4 to 5min series with 1min rest *vs*. seconds *vs*

Source: ALONGO et al., 2024

Measurement and testing

Anthropometric variables

Height is the distance from the bottom of the feet to the top of the head, measured with a two-meter high "Somatometer"." Somatometer Technique: Barefoot subject stands upright, feet together, arms at sides, gaze horizontal. The Somatometer cursor is lowered until it touches the player's head. Read the scale indicated by the cursor.

The weight

The weight (P) of a handball player was assessed using a "TANITA" personal scale calibrated in Kilograms (Kg). Technique: The subject removes his or her pair of shoes, stands looking horizontally, arms in line with the body, and his or her weight is indicated on the scale's dial. Weight measurement is also used to calculate body mass index (BMI). BMI= P/T2(in cm), BMI: Body Mass Index in kg/m2; T: Height in meters (m); P: Weight in kilograms (kg).

Studied variables

In this study, independent, dependent and confounding variables were measured.

Independent variable: age, height and weight

Dependent variables:

These were essentially: Total Fat Rate GT (%); Muscle Mass Rate MM (%); Visceral Mass Rate GV (%); Physical Capacity (PC).

Confounding variables:

These consist of temperature, water consumed, resting heart rate, average heart rate (Fcm) achieved during these activities, 24-hour sleep time during the study period, percentage of daily water loss during the study.

Statistical processing of data

Data was processed using IBM statistics 21.0 software. Means and standard deviations were used for the variables. The normality of the distribution of variables was verified by the Shapiro-WILK test. The confidence level was set at 95%, with 05% representing the significance level of all statistical tests ($p<0.005$). The statistical treatment of the study data was based on the difference between the mean before and after four months. Student's t-test was used to identify paired samples. An analysis of variance (ANOVA) was used to determine significant differences between several modalities. According to the World Health Organization (WHO) classification, we have:

Table 3: WHO body mass index classification

Values Interpretation of the organization	Values Interpretation of the organization
Organization	organization
BMI< 18.5 Malnutrition	BMI< 18.5 Malnutrition
18.5<BMI< 24.9 Ideal weight	18.5<BMI< 24.9 Ideal weight
25<BMI< 29.9 Overweight	25<BMI< 29.9 Overweight

Source: WHO, 2006.

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RESULTS

In order to examine the effects of a sedentary lifestyle on body composition values and female shopkeepers and growers cycling, we present these results as follows: Anthropometric characteristics, physical constitution variables.

1. Anthropometric characteristics

Table 4: Anthropometric variables of traders before and after a four-month period.

Variables	Trader (n=31)		
	Before	After	P
Age (year)	26,73±4,07	26,73±4,07	NS
Height (m)	1,67, ±0,09	1,66±0,09	NS
Weight (Kg)	86,10±5,76	98,42±5,48	<0,001
BMI (Kg/m2)	27,88±1,37	29,64, ±1,31	<0,001

Source: ALONGO et al., 2024

legend: BMI: Body Mass Index; NS: non-significant difference, $p>0.05$; S*: significant difference, $p<0.05$; S**: highly significant difference, $p<0.01$; S**: highly significant difference, $p<0.001$. Analysis of this table shows a non-significant difference in the values for height and age. However, the values for weight and BMI show a highly significant difference ($p<0.001$) for shopkeepers.

Table 5: Anthropometric variables of female farmer-cyclists

	Variables Before	Shopkeepers After	P
Age (year)	27,27±4,04	27,27±4,04	NS
Height (m)	1,69 ±0,06	1,69±0,06	NS
Weight (Kg)	68,19±3,94	64,23±3,83	<0,001
BMI (Kg/m²)	22,59±1,92	21,46, ±1,96	<0,001

Source: ALONGO et al., 2024

Legend: NS: difference Not Significant P>0.05; S*: significant difference, P<0.05; S**: very significant difference P<0.01; S**: highly significant difference p<0.001

This table shows a non-significant difference in the height and age values of female farm cyclists. However, the values for weight and BMI for Female Farm Cyclists show a highly significant difference (p<0.001) from those for Female Shopkeepers.

Table 6: Variable Body Composition of Shopkeepers Before and after a Three-Month Period of Activity.

	Variables Before	Shopkeepers After	p
GT (%)	28,12±9,91	32,34±4,96*	<0,001
GV (%)	7,87, ±0,54	9,17±2,00*	<0,001
MM (%)	41,62±1,84*	39,57±5,28	<0,001
CP	5,09±0,84 *	4,02±0,74	<0,001

Source: ALONGO et al., mai 2024

Legend: GT (%): Total Fat Rate; MM (%): Muscle Mass Rate; GV (%): Visceral Mass Rate; CP: Physical Capacity; NS: non-significant difference, p>0.05; S*: significant difference, p<0.05; S**: highly significant difference, p<0.01; S***: highly significant difference, p<0.001. The results obtained from this table show that the values of GT (%) and GV (%) of post-trade traders were highly significant (p<0.001). Whereas the MM (%) value of traders before trade showed a highly significant difference (p<0.001).

Table 7: Anthropometric Variables of Women Traders and Farmers Before and After Three Months of Activity

Variables	Shopkeepers (n=31) Before	Women cyclists (n=32) After	p
Age (year)	26,73±4,07	27,27±4,04	NS
Height (m)	1,67, ±0,09	1,69±0,06	NS
Weight (Kg)	94,42±5,48**	64,23±3,83	<0,001
BMI (Kg/m2)	29,64±1,31***	21,46±1,89	<0,001

Source: ALONGO et al., 2024

Legend: NS: non-significant difference; p<0.01: highly significant difference; p<0.001: highly significant difference. Reading this table, we see that the age and height values of the cycling traders and growers after the activity show a non-significant difference (p<0.05). On the other hand, the values for weight and BMI among the shopkeepers and cyclists after the activity were high

Table 8: Variability in Body Composition of Shopkeepers and Farmers Cycling After the Activity.

Variables	Shopkeepers (n=31)	Women farmers (n=32)	p
GT (%)	32.34±4.96***	26.12±9.91	<0.001
(GV) (%)	9.17 ±2.00***	1.87±0.54	<0.001
MM (%)	39.57±5.28	40.62±1.84***	<0.001
CP	4.02±0.74	9.02±0.12***	<0.001

Source: ALONGO et al,2024

Legend: GT (%): Total Fat Rate; MM (%): Muscle Mass Rate; GV (%): Visceral Mass Rate; CP: Physical Capacity; NS: non-significant difference, p>0.05; *: significant difference p<0.05

** : highly significant difference, p<0.01; *** : highly significant difference, p<0.001.

The results obtained from this table showed that the GT (%) and GV (%) values of shopkeepers after daily activity were highly significant (p<0.001). On the other hand, the MM (%) and CP values of female cyclists after daily activities showed a highly significant difference (p<0.001). However, physical capacity showed a highly significant difference between the two groups.

Table 9: Comparison of WHO Body Mass Index Classification between Female Farmer-Cyclists and Female Shopkeepers

BMI values	WHO interpretation	Bicycle growers (n=32)	Tradeswomen (n=31)	p
IMC<18,5	Malnutrition	0(0%)	0(0%)	NS
18,5<IMC<24,9	Poids ideal	32(100%) ***	6(19,35%)	<0,001
25<IMC<29,9	Surpoids	0(0%)	17(54,84%)	<0,001
IMC >30	Obésité	0(0%)	8(25,81%) ***	<0,001
Total		32	31	

Source: ALONGO et al, 2024

Legend: NS: non-significant difference p<0.01: highly significant difference, p<0.001: highly significant difference.

The results obtained from this table showed that the WHO classification of body mass index between women traders and women farmer-cyclists was highly significant (p<0.001)

in favor of women farmer-cyclists. However, overweight and obesity were very noticeable among women traders

DISCUSSION

The work in this dissertation was carried out with the aim of evaluating and comparing the effects of physical activity on the physical constitution of women farmer-cyclists and women traders from Makoua in the Cuvette Congolaise. At the start of the study, we hypothesized that the commercial activity of women farmers-cyclists would induce greater adaptations in physical fitness than that of women traders. The verification of this hypothesis is based on a methodology adapted to the environment of the field of investigation and the geomorphological context. The measurements and tests have been validated by the scientific community. To verify this hypothesis, we conducted a prospective cross-sectional study using research in life and health sciences in general, and exercise physiology in particular. In fact, physical activity is determined by several factors, including anthropometric characteristics and the various motor tasks associated with it, notably the distance cycled.

Anthropometric values

The results obtained show that female farmer-cyclists and female shopkeepers have lower values before and after the experimental program for commercial and agricultural activities and combined cycling. For age (26.73±4.07y *vs*. 27.27±4.04y), height (1.67±0.096kg *vs*. 1.69±0.06kg), weight (86.10±5.76kg *vs*. 68.19±3.94kg) and BMI (27.88±1. 37kg.m-2 *vs*. 22.59±1. 92kg.m-^{2}) (Table 2 and 3). These results show a tendency for women traders to be overweight. These results are similar to those of Wang ZM, 1992, p.19-28, according to whom weight is influenced by the type and volume of training. High training volumes of at least 200 minutes/week promote significant weight reduction. Mass regression is also greater with aerobic training than with combined aerobic and resistance training. This is why exercise intensity does not significantly influence weight loss, but does significantly reduce waist circumference.[9] Indeed, the difference in body mass values is explained by the fact that women farmers- cyclists, the activity is very intense which allows to burn fat while spending energy by cons in women traders the tendency of overweight is due to the least effort they provide therefore they accumulate a lot of reserve in the form of fats. Correa et al., report that the caloric expenditure in cycling is about 400 to 600 kilocalories per hour for a practice in hiking and 600 to 800 kcals per hour in competition.[10] This expenditure is higher in mountain biking than on the road because the more the muscles work, the more muscle volume gains in this discipline. In the factors involving weight gain, it is necessary to emphasize the energy balance. A positive energy balance, that is, an intake of food that exceeds the basic energy expenditure, is the direct cause of weight gain. Physical activity therefore helps to preserve lean mass during weight loss with an energy restriction. The results of the table show that the values of weight and BMI of women traders are higher than in women farmers-cyclists (94.42 5.48 *vs* 64.23 3.83; 29.64 1.31 *vs* 21.46 1.89) after effort, these values, show a highly significant difference ($p<0.001$). This difference is explained by the fact that the practice of activity among women farmers-cyclists is very intense and important. These results are similar to those of Mabassa et al., 2019.[11] These results show that aerobic physical exercise such as walking, at moderate intensities, improves cardiovascular health. This reduces the risk factors for obesity in women traders. By extrapolation, women traders were likely exposed to cardiovascular and metabolic complications. This is the reason for the training program of active walking, aerobic and rhythmic gymnastics combined with muscle building exercises, stretching, flexion, abdominal and Low-calorie diet, high in fiber and vitamins.

Values of body composition of practitioners

The physical fitness values of women farmers-cyclists and women traders before and after exercise show us a highly significant difference ($p<0.001$) in favor of the traders. Regarding the total fat ratio, a significant decrease was observed before effort however, an increase was observed after effort in particular 28.12 9.91 *vs* 32.34 4.96 in women traders by contrast the values of women farmers. The number of women who have been able to exercise before and after a is higher than that of those who have been able to do so, 32.34 4.96 *vs* 26.12 9.91; for the rate of muscle mass (%): 41.62 1.84 *vs* 39.57 5.28 *vs* 39.57 5.28 *vs* 40.62 1.84; and then the percentage of visceral mass (%) of women farmers cyclists are higher before effort, unlike women traders:7.87 0.54 *vs* 9.17 2.00 *vs* 9.17 2.00 *vs* 6.87 0.54 table (4 and 5). These results can be explained by the daily activity practice, a very high frequency, volume and intensity of work performed by women farmers-cyclists. These results are also similar to the body composition analysis by Campa et al., 2021.[13] They reveal that fat mass is positively influenced by large training volumes and high intensity. Endurance training results in a significant decrease in fat mass to achieve a significant increase in lean mass. Indeed, the training must contain a muscular resistance or strength component. It is in this perspective that the European guidelines promote motor activity as a means to fight obesity. They recommend a minimum of 150 minutes/week of endurance training, combined with three sessions per week of muscle resistance training. This allows to preserve or even increase the lean mass that determines energy expenditure and thus optimizes weight loss.[14] Regular physical activity plays a major role in controlling body mass and motor skills in children. However, the majority of children with overweight are hypoactive and their adherence to physical activities is spontaneously low.[15] Regarding the percentage of

total fat and visceral mass, a significant decrease was noted after the effort in women Farmer-cyclist, by contrast in women traders an increase is observed after the program:26.12 9.91 *vs* 32.34 4.96; 6.87 0.54 *vs* 9.17 2.00 (Table 7). This significant reduction in female Farmer-cyclist is similar to the work of Dulloo, suggests that regular physical activity allows for long-term weight loss in an obese person.[16] It seems important to combine a rebalancing of the volume of work through field tasks and professional physical activity.[17] Similarly, the study of Jeffrey et al., showed that the greater the energy expenditure from manual physical activity, the greater the weight loss (Tables 4, 6 and 7).[18] In terms of the results obtained, we note that the use of the countryside and cycling represents another way to improve the health status of farmers. Indeed, this gain in volume and intensity of work is a solution to minimize the weight gain associated with menopause.et thus decrease 30% to 50% the incidence of cardiovascular diseases. In addition, it increases the overall energy deficit and decreases fat mass while preserving lean mass, which contributes greatly to long-term maintenance of weight loss (Tables 7, 8 and 9). The influence of physical activity among women traders in improving their health is therefore of paramount importance. It is important to note that women in good physical condition have lower risk factors for obesity and cardiovascular disease than other women who are in poor health. Excess adiposity is one of the factors in mortality among obese women. It should be noted that these women traders may have a weight reduction, following physical activity, independently of a reduction in their corpulence and their level of abdominal obesity. Also, aerobic type physical activity such as walking, has a moderate intensity is a way to improve the cardiovascular health of the woman trader. Reason why it is fair to say, walking an hour a week at a moderate pace reduces the risk of disease in women by 50%. Walking is also a way to start regular physical activity and gradually incorporate it into daily life. Walking is a very accessible, inexpensive activity that women quickly adopt and rarely involves serious risk of injury. To this end, women farmers-cyclists who regularly practice aerobic endurance physical activity do not gain weight and do not show an increase in abdominal fat. This experiment suggests an increase in physical condition and weight loss and a decrease in subcutaneous and visceral fat in women traders (Table 8). On another occasion, recent literary reviews on the recommendation of the WHO, 2020 showed that adolescents should replace the time they are sitting or sitting on their screens with moderate to sustained volume and intensity exercise while maintaining adequate sleep duration can have additional health benefits. Lack of physical fitness is one of the major risk factors for mortality in today's world and it contributes to the rise of overweight and obesity.

The results in Table 9 report that the values according to the WHO classification of body mass index between female traders and female farmers-cyclists are highly significant ($p<0.001$) in favour of female farmers-cyclists. However, overweight and obesity are very noticeable among female traders. These results clearly reflect that these agricultural activities and associated with the bicycle, contribute to the volume and intensity of work high compared to the market marketing activities, whose tasks are sometimes seated.

CONCLUSION

The daily physical activities of women traders are more sedentary than for their counterparts' farmers which justifies the high percentages of overweight and obese subjects among these women traders. To overcome this sedentary nature, it is imperative to voluntarily accept the exercise adapted and complementary to their abilities. An adapted active program is interesting when it is known that women traders at these ages do not practice exercise. Taking into account the beneficial effects of a program, we encourage and support women traders to complete their daily work by walking in order to regulate their sedentary state.

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Ethical consideration: This project was approved by the laboratory of the physiology of the effort of the biomechanics of the higher institute of physical and sports education. All information about this study was communicated to each participant in writing and verbally in the language «akwa», after each measurement. All participants gave informed consent. Ethical clearance for Health Sciences Research Ethics Committee from the of the General Delegation for Scientific and Technological Research under number 001-22/MESR-SIT/DGRST/CERSSA/-24.

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RÉFÉRENCES

1. Bailey R, Charles H, Shawn A, Petitpas A. Physical Activity: An Underestimated Investment in Human Capital? Journal of Physical Activity and Health (JPAH). 2013; 10(3): 289-308. https://doi.org/10.1123/jpah.10.3.289
2. Saunders TJ, Gray CE, Poitras VJ, Chaput JP, Ian J, Peter TK, Timothy O, Sarah C et al. Combinations of physical activity, sedentary behaviour and sleep: relationships with health indicators in school-aged children and youth. Appl Physiol Nutr Metab. 2016;41(6 Suppl 3):S283-S293. doi:10.1139/apnm-2015-0626
3. Hampig RK, Fahad I, Joseph Z, Nabih N, Salah A, Nasr A et al. The first Middle East and North Africa expert consensus recommendations for the management of advanced colorectal cancer. Future Oncol. 2022; 18(24): 2733-2744. doi:10.2217/fon-2022-0282.
4. Caspersen CJ, Powell KE, Christenson GM. Physical activity, exercise, and physical fitness: definitions and distinctions for health -related research. Public Heath Reports. 1974; 2: 126-131.
5. Stellman JM. Encyclopédie de sécurité et de santé au travail. Bureau International du travail, Chantal Dufresne, 2009, ISBN 92-2-209814-5.
6. Broustel JP. Actualités et dossiers en santé publique mars 1996, XVI, 14.
7. Sonko M. Effects of Physical Activity Practice on Physiological Qualities and Anthropometric Variables in Senegalese Adult Women. Master's Thesis in STAPS INESPS/UCAD, 2005.
8. Campa F, Toselli S, Mazzilli M, Gobbo LA, Coratella G. Assessment of Body Composition in Athletes: A Narrative Review of Available Methods with Special Reference to Quantitative and Qualitative Bioimpedance Analysis. Nutrients. 2021; 13(5): 1620. doi:10.3390/nu13051620.
9. Correa JB, Apolzan JW, Shepard DN, Heil DP, Rood JC, Martin CK. Evaluation of the ability of three physical activity monitors to predict weight change and estimate energy expenditure. Appl Physiol Nutr Metab. 2016;41(7):758-766. Doi:10.1139/apnm-2015-0461.
10. Mabassa DS, Itoua Okemba J, Alongo YRG, Massamba A. Influence de l'activité physique gymnique aérobic sur la composition corporelle des femmes ménopausées obèses du Congo-Brazzaville. Int. J. Sports Health Phys. Educ. 2019; 6(5): 42-46.
11. WHO. A healthy lifestyle - WHO recommendations. 2017.
12. Campa F, Toselli S, Mazzilli M, Gobbo LA, Coratella G. Assessment of Body Composition in Athletes: A Narrative Review of Available Methods with Special Reference to Quantitative and Qualitative Bioimpedance Analysis. Nutrients. 2021; 13(5): 1620. Published 2021 May 12. doi:10.3390/nu13051620
13. Ravussin E, Lillioja S, Anderson TE, Christin L, Bogardus C. Determinants of 24-hour energy expenditure in man. Methods and results using a respiratory chamber. J Clin Invest. 1986;78(6):1568-1578. doi:10.1172/JCI112749
14. Ben-Slama F, Skiri H, Ben-Romdhane H, Zouari B. La perception de l'obésité infantile par les mères. Revue Maghrebine de Pediatrie : 2005; 14(4): 181-186.
15. Dulloo AG, Jacquet J. Un contrôle spécifique du tissu adipeux de la thermogenèse dans la régulation du poids corporel. Int J Obes Relat Metab Disord. 2001; Suppl 5 : S22-9. doi: 10.1038/sj.ijo.0801907.
16. Ballor DL, Poehlman ET. Exercise-training enhances fat-free mass preservation during diet-induced weight loss: a meta-analytical finding. Int J Obes Relat Metab Disord. 1994; 18(1):35-40. 18:35-40.
17. Jeffery RW, Wing RR, Sherwood NE, Tate DF. Physical activity and weight loss: does prescribing higher physical activity goals improve outcome?. Am J Clin Nutr. 2003; 78(4): 684-689. doi:10.1093/ajcn/78.4.684.
18. Moussouami SI, Nigan IB, Alongo YRG, Gouthon P, Mbemba F. Prevalence, Factors Associated with Obesity and Overweight among Students in Brazzaville in 2020. Food and Nutrition Sciences (FNS). 2022 ; 13 :65-77. https://doi.org/10.4236/fns.2022.131007