Available Online at http://www.journalajst.com

ASIAN JOURNAL OF SCIENCE AND TECHNOLOGY

ISSN: 0976-3376

Asian Journal of Science and Technology
Vol. 15, Issue, 12, pp. 13330-13334, December, 2024

RESEARCH ARTICLE

EFFECTS OF THE PRACTICE OF THE GAME OF LIPATO IN THE WATER ON THE BODY COMPOSITION IN HIGH SCHOOL COLLOGIANS

ALONGO Yvon Rock Ghislain [1]*, MOUSSOUAMI Innocent Simplice [1], MABOUNDA KOUNGA Paul Roger[1], OBELA IBATA Gency Espoir[1] and ITOUA ONIANGUET OSSOBA Kiel[1]

Physiology of effort and biomechanics laboratory, Higher Institute of Physical and Sports Education of Marien NGOUABI University, BP: 69, Brazzaville

ARTICLE INFO

Article History:
Received 17th December, 2024
Received in revised form
24th December, 2024
Accepted 28th December, 2024
Published online 30th December, 2024

Keywords:
Practice, "Lipato" Game, Body Composition, Students and Congolese.

ABSTRACT

Breast The main objective of this study was to show the effects of the practice of extra-curricular activities based on the game of "lipato" on the body composition and blood pressure values of high school students. It involved 64 subjects, aged between 19 and 22, divided into two groups: GE (32) experimental group and GT (32) control group, experimental protocol of the "lipato" game during 3 months of school holidays. The determination of the anthropometric variables of height and weight with a measuring rod and a bathroom scale and the body composition variables with the impedance meter. All these measurements are taken before and after the experiment. The results obtained show an improvement in anthropometric variables, composition in favor of the experimental group respectively (weight 25.80 ± 4.27 vs 29.90 ± 3.89, BMI 21.67 ± 1.52 vs 24.41 ± 1.39 muscle mass 25.74±4.71 vs 29.97±3.89, water mass 10.27±3.44 vs 12.35±3.60). These results suggest that the optimal practice of the "lipato" game during the holidays favors the reduction of the prevalence of overweight.

Citation: ALONGO Yvon Rock Ghislain, MOUSSOUAMI Innocent Simplice, MABOUNDA KOUNGA Paul Roger, OBELA IBATA Gency Espoir1 and ITOUA ONIANGUET OSSOBA Kiel1. 2024. "Effects of the practice of the game of lipato in the water on the body composition in high school collogians", *Asian Journal of Science and Technology*, 15, (12), 13330-13334.

INTRODUCTION

Life is essentially centered on movement, whereas all movement involves ambulatory changes of position in space over time, relative to a reference system (Camargo, 2020). The school is an educational environment where there are several activities among many others, physical and sports education (EPS) which allows the development of the child, in particular in its management of the motor act. This constraint of school practice constitutes a means allowing the mobilization of the motor resources of the child in order to ensure his physical well-being. Activities allowing physical and cognitive development of the individual are named by Marchal and Parlebas: "traditional sports games". These practices belonging to a popular culture are non-institutional physical games rooted in a long cultural and local tradition such as: dodgeball, hopscotch, sparrowhawk, etc. These traditional games include games of skill, strength, senses, pursuit, throws as thinking games. This is how Parlebas compares them to codified sports activities by giving them the name of "flexibly codified" games. At school, the practice of physical activities was restricted to a few simple games carried out by the pupils themselves during recess and free time without any real direction from the teachers. This is how the free practice of traditional games began in the school environment. The Physical Education Charter recommends that physical education, physical activity and sport can play a significant role in developing the well-being, and the physical skills and abilities of participants by improving mastery, coordination, balance and movement control, as well as physical health, through prevention and therapeutic rehabilitation, at the time they are practiced and throughout life.

In the Republic of Congo, at the rural level, several extracurricular activities are practiced through, in particular the game of lipato. Indeed, Lipato is the most popular game among teenagers outside of school and especially during vacation periods. It is an extracurricular activity practiced in water by subjects in the framework of leisure in order to derive pleasure and amusement. The young subjects of this segment of the population devote themselves every day to this traditional practice in the context of leisure without taking into account the physiological adaptations it provides. However, the increase in sedentary behaviors in urban areas are caused by television screen time, video games, the Internet, computer games, cell phone communication, phone games... This translates to these the genesis of obesity and overweight problems (Gortmaker SL, 2005). In 2020, a group of researchers examined the links between aerobic fitness, level of physical activity and risk of cardiovascular disease. While the risk was lower in subjects with high aerobic fitness than in those with low aerobic fitness, the difference was smaller between those with the highest and those with the lowest levels of physical activity (Maude Gingras, 2020). There are a number of reference social practices often not used at school level that are regularly practiced among students and occupy a very important place in the development of their physical life. For its part, the game of aquatic Lipato is a traditional game including motor skills which is characterized by sequences of chases, accelerations and slowdowns, feints and changes of direction in the water, this is the specific side of the game. In this regard, the World Health Organization (WHO) has just made the fight against physical inactivity one of the priorities among children (Clark H., 2020).

While moderate to very intense physical activity corresponds to energy expenditure ranging from 3 to 9 METs, sedentary lifestyle is characterized by a daily energy defense of less than 1.6 METs (Tremblay MS., 2020). In the Congolese context, extracurricular physical activities are influenced by the behavior of parents, who are unaware of the undeniable contributions of these activities on health. Wouldn't this indifferent way of parental action be rather unfavorable to the health of these students?

It is in view of this problem that we are carrying out a prospective study on the effects of the practice of the game of "lipato" on body composition in middle and high school students. Among the extracurricular activities based on the game of "lipato" do they induce physiological adaptations of schoolchildren? What are the effects of the practice of the game of "lipato" on the body composition variables of high school students? In an attempt to answer these questions, we formulate the following hypotheses: physical activities based on the game of "lipato" allow changes in the variables of the body composition of schoolchildren. This study, we set a number of objectives, namely: to show the effects of the program of practice of the game of "lipato" on the body composition during the holidays. The secondary objectives assigned to this study are to evaluate the effects of the practice of the game of lipato on the variables of the body composition of high school students; to compare the variables of the body composition of schoolchildren in the experimental group and the control group. This study aims and interest to show that the practice of extra-curricular activities based on the game of "lipato", although it is beneficial from a playful and health point of view. Thus the awareness of all in the preservation of physical health through the practice of the game of "lipato".

METHODOLOGY

Type of study and period and field of intervention: Our study is of an experimental type, it was carried out in the district of Makoua located in the northern part of the Republic of Congo, in the department of the central basin, more precisely in the Lobi river of Likouala mossaka in the period from from July 14 to September 28, 2022. The choice of this field of intervention is motivated by the fact that this locality is a rural environment with the practice of water games including the game of "lipato". So this locality can produce real and viable data for us.

Attendees: Our target population consisted of adolescent subjects from the district of Makoua whose age varies from 19 to 23 years. A representative sample with the same characteristics with the parent population was randomly selected. It consisted of 64 subjects divided into two groups, namely: the experimental group (32 subjects) and the control group (32 subjects) who met the inclusion and exclusion criteria. Indeed, were included all subjects whose age varies from 19 to 22 years of both sexes and practicing the game of "lipato" in an aquatic environment. For the exclusion criteria, all subjects who had not completed the 3 months of experimental practice were excluded from our study.

Experimental procedure

Table 1. The water game activity program the daily lipato

Schedule	The cat or "hunter"	The mouse or "game"
Spot spot time	2 to 5 min Max	8 to 10 mins
breaks	2 to 3 minutes	2 to 5 minutes
Volume of work	2h-2h30 on average	2h-2h30 on average
Without rest	2 to 3 sets with 10 second rest	2 to 4 sets with 1min rest

Source: alongo et *al*., 2022

Measurements: Stanley brand two (2) meter height measuring rod (Precision: 10 mm by default) to measure height; an Omron brand scale (EU) calibrated in kilograms (kg) for weight measurement; a TANITA BC-545 FITSCAN impedance meter for the evaluation of body composition variables (Muscle mass; Body mass index; Percentage of water mass). The body mass index (BMI) which was the quotient of the weight and the square of the height in m. The body mass index is used to determine and assess overweight according to the following formula: BMI is equal to the ratio of weight to height squared, Body mass index in kg/m2; Height in meter (m); P: Weight in kilograms (kg)

Table 2. Represents body mass indices used to determine and assess overweight or nutritional status

Body Mass Index (BMI)	Interpretation
BMI >29,3 or more	Obesity
BMI of 25,0-29,2	Overweight
BMI of 17,3-24,9	Normal nutritional status
BMI 15,7-17,2	Moderate malnutrition
BMI <15,7	Severe malnutrition

Source: WHO., 2006

Statistical analysis: Data were entered using SPSS23.0 software. The quantitative variables were expressed as the arithmetic mean accompanied by the standard deviation. The comparison of two means for the continuous variables was carried out by the paired Student's t test to examine the effect of the physical activity program on each parameter of interest in the two groups. For the comparison of the same variable between the subjects of the experimental group and those of the control group, the Student's t test for unpaired series was used. The value of p equal to 0.05 was considered as the threshold of statistical significance. All subjects had consented in writing to participate in the study according to the Declarations of Helsinki.

RESULTS

Table 3. Represents the anthropometric variables compared before and after the experimentation of the experimental group (EG) in the form of a mean plus or minus standard deviation

Anthropometric variables	GE (n=32)		P
	Avant	Apres	
Age (years)	21,06± 1,95	21,06± 1,95	NS
Size(cm)	1,67±0,08	1,67±0,08	NS
Weight (kg)	65,10±2,45***	62,80±4,27	<0,001
BMI (kg/m^2)	23,19±1,53***	20,67±1,52	<0,001

Abbreviations: BMI: Body Mass Index; ***: highly significant difference and GE: experimental group.

This table shows us the subjects of the experimental group have an average age of 21.06 ± 1.95 and an average height of 1.37 ± 0.08. We also observe a highly significant difference in terms of weight and BMI, before and after experimenting with the lipato water game in favor of the pre-test. However, no difference was observed in terms of age and size.

Table 4. Shows the comparison between the anthropometric variables before and after three months of vacation in the control group (GT) as mean plus standard deviation

Anthropometric variables	GT (n=32)		P
	Avant	Apres	
Age(years)	21,05± 1,96	21,05± 1,96	NS
Size(cm)	1,66±0,05	1,66±0,05	NS
Weight (kg)	64,80±4,45	68,80±4,27***	<0,001
BMI (kg/m^2)	22,49±1,53	25,67±1,52***	<0,001

Abbreviations: BMI: Body Mass Index; ***: highly significant difference

This table shows us the subjects of the control group have an average age of 21.05 ± 1.96 and an average height of 1.66 ± 0.05. We also observe a highly significant difference in terms of weight and BMI, before and after experimenting with the lipato water game, in favor of the post test. However, no difference was observed in terms of age and size.

Table 5. Shows the comparison of the means of "body composition" between the pre- and post-exercise of the experimental group in the form of a mean plus or minus standard deviation

Body composition	GE (n=32)		P
	Avant	Apres	
MM (%)	23,80±4,45	26,80±4,27***	<0,001
BMI (kg/m^2)	23,19±1,53***	20,67±1,52	<0,001
MH (%)	11,42±4,32***	9,78±3,71	<0,001

Abbreviations: MM: muscle mass; BMI: body mass index and %MH: body water percentage; GE: experimental group. It emerges from this reading, a highly significant difference before and after the experimentation of the lipato game of the subjects of the Experimental group of the variables of the body composition of the subjects of the experimental group: MM (%) in post-test, P<0.001, BMI and MH (-%) pre-test.

Table 6. We present the mean plus or minus standard deviation of the different body composition variables of the subjects in the control group

Body composition	GT (n=32)		P
	Avant	Apres	
MM (%)	26,10±4,45***	23,80±4,27	<0,001
BMI (kg/m^2)	23,19±1,53	25,67±1,52***	<0,001
MH (%)	11,21±4,32	12,78±3,71***	NS

Abbreviations: MM: muscle mass; BMI: body mass index %MH: body water percentage and GT: control group.

The table shows us the muscle mass (26.10±4.45 vs 23.80±4.27) has greatly regressed, while the body mass index (23.19±1.53 vs 25.67±1 .52) increased and body water percentage increased a little.

Table 7. Comparison of anthropometric variables between the two groups. GE and GT, before and after experimenting with aquatic lipato

Anthropometric variables	GE (n=32)	GT (n=32)	P
	Après	Après	
Age(years)	21,06± 1,95	21,05± 1,96	NS
Size(cm)	1,67±0,08	1,66±0,05	NS
Weight(kg)	23,19±1,53	25,67±1,52***	<0,01
BMI (kg/m^2)	20,67±1,52	25,67±1,52***	<0,01

Abbreviations: BMI: body mass index; GE: experimental group, GT: control group and NS: non-significant difference.

The results in this table showed a non-significant difference in age and height between the control group and the experimental group. In addition, there is a very significant difference in weight (23.19 ± 1.53 vs 25.67 ± 1.52) and BMI (20.67 ± 1.52 vs 25.67 ± 1.52) in favor of the control group.

Table 8. Comparison of body composition variables between the control group and the experimental group

Body composition	GE (n=32)	GT (n=32)	P
	Après	Après	
MM (%)	26,80±4,27***	23,80±4,27	<0,01
BMI (kg/m^2)	20,67±1,52	25,67±1,52***	<0,001
MH (%)	9,78±3,71	12,78±3,71***	<0,001

Abbreviations: MM: muscle mass; BMI: body mass index and %MH: body water percentage; GE: experimental group and GT: control group.

Reading the results recorded in this table shows a very significant difference in muscle mass in favor of the experimental group (26.80±4.27 vs 23.80±4.27). However, a very significant significant difference is observed in body mass index (20.67 ± 1.52 vs 25.67 ± 1.52) and water mass in favor of the control group (9.78 ± 3.71 vs12.78±3.71).

DISCUSSION

This study produces data on body composition among high school and college students practicing the game of "lipato" living in rural areas. In addition, some anthropometric variables have been studied explanatory values. It allows the justification of our hypothesis according to which the extracurricular activities in particular of the aquatic game of lipato, allows the reduction of the fat mass in favor of the lean mass of the subjects during the vacation period.

Anthropometric values: We were able to observe that water game practitioners in rural areas recorded an improvement in anthropometric variables at the level of the experimental group (EG) and others maintained their values in particular. However, the opposite fact is observed in the control group (GT). Table 3 showing the comparison of anthropometric variables before and after the experimental group (EG) experiment shows that subjects have an average age of 21.06±1.95 and an average height of 1.37±0.08. We also observe a highly significant difference in terms of weight and BMI, before and after experimenting with the lipato water game in favor of the pre-test. However, no difference was observed in terms of age and size. In addition, Table 4, showing the comparison of anthropometric variables before and after the experimentation of the control group (GT), shows the opposite effects, in particular an increase in weight and body mass index. Again, the results obtained from the comparison between the two groups after experimenting with the aquatic game of lipato as an extracurricular activity, show us that the anthropometric variables of the subjects of the experimental group and the control group are statistically similar, in particular age (21.06± 1.95 vs 21.05± 1.96) and height (1.67±0.08 vs 1.66±0.05) (table 7). However, highly significant differences were observed in weight (23.19±1.53 vs 25.67±1.52) and BMI (20.67±1.52 vs 25.67±1. 52) in values of the control group (Table 7 and 8). These differences are due to the effect of the practice of the conditioning program based on the aquatic game of "lipato" in the subjects of the experimental group. Indeed, any physical activity is dependent on the mobilization of a physiological state, that is to say, it creates physiological adaptations. These results are similar to the work of Gatera G et al., 2020, according to which weight is influenced by the type of training as well as its volume. Large training volumes of at least 200 minutes/week promote significant weight loss. Weight loss is also greater when practicing aerobic training compared to training combining aerobic and muscular resistance. The intensity of the effort does not significantly influence weight loss, but can significantly reduce waist circumference (Gatera G et al., 2020).

The BMI of the subjects were calculated and fixed the subjects of the two groups in a normal nutritional state according to the WHO grid of (2007). Moreover, it is recognized that obesity and overweight are dependent on a sedentary lifestyle and low participation in physical activity. This allows us to say that our series is focused on normal subjects from the point of view of the body mass indicator; according to the Cachera and WHO assessment scale in 2007. Indeed, our series is similar to the work carried out by Chillon, relating to subjects living in rural areas of a Spanish population who presented a significantly higher speed than their urban peers and also, they could observe that the urban subjects were not more active than they maintained good physical shape although the high percentages of body mass. Recent studies show that the time spent in sedentary activities still plays a considerable role in the genesis of weight problems in children and adolescents in the rapid increase in overweight among this segment of the population. This is how video games, the internet, computer games, television, mobile phone communication and phone games are indexed a lot lately (Gortmaker SL, 2005). However, our study was carried out on a non-urban population. To this end, (Chillon, 2017), associates the explanation of its deviations with the lifestyle that would influence body composition and physical condition during adolescence. On the one hand, industrialization and mechanization are associated with modernization and also lead to the social and economic development of cities. This socio-economic development influences the behavior of inhabitants, impacting the rate of obesity in urban areas (Coudrary, 2016.). Moreover, overweight is associated with a lifestyle and has a socio-economic status on the one hand, and on the other hand associated with breakfast for little boys (Frayon, 2017). The very significant decrease in BMI after exercise is linked to the drop in fat mass. It is important to note that a high basal metabolic rate is

correlated with a high rate of lipid oxidation, which predicts a decrease in weight gain over the years. This is why considering the effects of exercise on these anthropometric variables (weight and height) as part of a strategy to prevent or treat obesity. This is why (Zurlo F, 1990) reports that physical exercise is a means of combating childhood obesity. Practitioner Body Composition Values. Body composition in terms of fat mass variable, its distribution in the body and the morbidity associated with it differ from person to person. The distribution of fat mass plays a major role in the risks associated with obesity. As such, body composition values were at the center of our study. This study allowed us to evaluate the effects of the practice of the aquatic game of "lipato" on body composition. The results recorded in Tables 8 show a very significant difference in muscle mass in favor of the experimental group (26.80±4.27 vs 23.80±4.27).

However, a very significant significant difference is observed in body mass index (20.67 ± 1.52 vs 25.67 ± 1.52) and water mass in favor of the control group (9.78 ± 3.71 vs12.78±3.71). These differences between the GE and the GT are explained by the accumulation of adipose mass in the subjects of the control group which is responsible for the high weight unlike that of the experimental group related to the lean mass. Indeed, this high significance due to the effect of the practice of the training program based on the game of "lipato" was also observed before and after the effort in the experimental group (Table 2). This high significance testifies to the beneficial effects of physical activity on body composition, promoting an increase in muscle mass and a reduction in body mass index and body water percentage in the experimental group. To do this, students should practice extra-curricular activities such as lipato during vacation periods to ensure the reduction of overweight, which is a trigger index of obesity and many other pathologies to guarantee the good health.
It is with this in mind that the European guidelines for the management of obesity (World Health Organization, BMI Classification 2017 recommend the practice of endurance training lasting at least 150 minutes/week, associated muscle resistance training three sessions per week, which helps preserve or even increase lean body mass, which determines energy expenditure and thus optimizes weight loss (Ravussin E., 1986). important in the control of mass and body composition in children.However, the majority of overweight children are hypo-active and their adherence to physical activities is spontaneously low (Ben Slama F, 2002).These results are in connivance International Charter of Physical Education, Physical Activity and Sport, which recommends physical education, physical activity and sport play can play a significant role in the development of well-being, and skills and physical abilities of participants by improving mastery, coordination, balance and movement control, as well as physical health, through prevention and therapeutic rehabilitation, at the time of practice and throughout life.

Furthermore, also reiterates that physical education, physical activity and sport can improve well-being and psychological capacities by enhancing physical confidence, self-esteem and self-efficacy, reducing stress , anxiety and depression, developing cognitive functions and acquiring a wide range of skills and qualities that are a factor in success in play, learning and other aspects of life. Other times, recent literature reviews on the WHO recommendation, 2020 have shown that subjects should replace immobilization time or sedentary screen time with moderate-to-vigorous-intensity physical activity while maintaining a duration getting enough sleep can have additional health benefits. Physical inactivity is one of the major risk factors for mortality worldwide and contributes to the rise in overweight and obesity. Early childhood is a period of rapid physical and cognitive development where the habits of the child are formed and where it is possible to change and adapt the rules of family life. To this end, the physical activity recommended for children aged 5 to 17 to improve cardiorespiratory endurance, muscle shape, bone condition, cardiovascular and metabolic biological markers and to reduce symptoms of anxiety and depression is a cumulative total of at least 60 minutes per day of moderate-to-vigorous-intensity physical activity in the form of games, sports, travel, hobbies, and physical education within the family, at school or during activities in the community.

However, if our results are extended by 4 months, they would coincide with those of Sofien Regaieg et al., (2015) on the Effect of a 4-month physical activity program on body composition, aerobic capacity and Perceived exertion score in obese boys vs. obese Tunisian girls, aged 10 to 12 years revealing a significant reduction in body composition values in both groups. According to the recommendations of the World Health Organization, children and adolescents (5 to 17 years old) should engage in at least 60 minutes a day of physical activity of moderate to vigorous intensity. They are also advised to perform vigorous-intensity activities at least three times a week to strengthen their muscle and bone system (WHO., 2020). Other times, it has been shown that people who have excellent aerobic fitness would therefore be twice as well protected from cardiovascular disease. It should be noted that the most effective way to improve body composition is the practice of aerobic activities of medium or high intensity, but that, in the case of equivalent total energy expenditure, intense activities are more effective. Indeed, aerobic fitness is not only genetic; it is possible to modify it and thus have a beneficial effect on mortality (Blair, 1995). Increasing the level of physical activity is a certain thing, it is better to do some physical activity than not at all, and doing more is even better (Rasmussen, 2018), (Saint-Maurice, 2019). In absolute terms, an increase in the level of physical activity has a greater effect in a person doing little or no doing than in a more active person. There does not seem to be an established threshold below which physical activity would not have a positive effect on well-being and health. In reality, the best is to do more, except perhaps for a tiny minority of individuals who would do too much. Even people with medium to high levels of physical activity can improve their well-being and health by increasing this level and diversifying their activities, i.e. practicing more physical activities (Kino-Quebec, 2020).

Limitations of the study: The results of our study must take into account a number of limitations. The first is that our results did not take into account a number of parameters such as the quality of sleep of the subjects. Another potential limitation in our study concerns the energy expenditure which was not evaluated in our series but this limitation did not influence our results. Which suggests that our methodological concerns do not harm the results.

CONCLUSION

Our study aimed to show the effects of the practice of the game of "lipato" on the body composition of schoolchildren during the holidays. Our hypothesis was: extra-curricular activities based on the aquatic game of lipato induce changes in body composition in schoolchildren. The results obtained show that the practice of the game of "lipato" is a physical activity favoring the modification of body composition. This significantly observed modification of the body composition allows us to affirm that our hypothesis is verified because the experimental group by the game of "lipato" allowed to prevent the risks of obesity and overweight. To this end, we suggest that parents allow children to practice extra-curricular physical activities during the holidays in order to reduce their sedentary behavior, which is the basis of several pathologies.

Acknowledgements: We authors thank all the PE teachers of the Edouard OMBETTA college and the Makoua high school, and particularly the Inspector, the Director of the college and the headmaster of the high school. We also acknowledge with gratitude the presence of middle school and high school students for their active participation. All have made this project possible.

REFERENCES

CAMARGO, Vinicius Silva de. VARA, Maria de Fátima Fernandes. (2020). Développement de la motricité humaine dans les cours d'éducation physique en tant que stratégies pédagogiques. Revista Científica Multidisciplinar Núcleo do Conhecimento. An 05, Ed.

11, vol. 08, p. 131-148. https://www.nucleodoconhecimento.com.br/education-physics-fr/motricite-hum

Comité scientifique de Kino-Québec 2020. Pour une population québécoise physiquement active : des recommandations – Faits saillants. kino-Quebec@education.gouv.qc.ca

E Ravussin, S Lillioja, T E Anderson, L Christin, and C Bogardus, 1986. Determinants of 24-hour energy expenditure in man. Methods and results using a respiratory chamber. J Clin Invest.; 78(6): 1568–1578. doi: 10.1172/JCI112749

F Zurlo , S Lillioja, A Esposito-Del Puente, B L Nyomba, I Raz, M F Saad, B A Swinburn, W C Knowler, C Bogardus, E Ravussin(1990). Low ratio of fat to carbohydrate oxidation as predictor of weight gain: study of 24-h RQ Am J Physiol. DOI: 10.1152/ajpendo.1990.259.5.E650

Gatera G, Pavarini G.Lancet. 2020. The voices of children in the global health debate 22; 395(10224):541-542. doi: 10.1016/S0140-6736(20)30364-0

Helen Clark 1, Awa Marie Coll-Seck 2, Anshu Banerjee 3, (2020). A future for the world's children? A WHO-UNICEF-Lancet Commission DOI: 10.1016/S0140-6736(19)32540-1

Martin Gillies Rasmussen 1, Kim Overvad 2 3, Anne Tjønneland 4, Majken K Jensen 5 6, Lars stergaard 1, Anders Grøntved(2018). Changes in Cycling and Incidence of Overweight and Obesity among Danish Men and Women. Med Sci Sports Exerc DOI: 10.1249/MSS.0000000000001577

Maude Gingras, M.-P. B. (2020). Pour une population québécoise physiquement active : des recommandations / Savoir et agir. (M. d. Québec, Éd.) Comité scientifique de Kino-Québec.

Organisation mondiale de la Santé. (2020). Lignes directrices sur l'activité physique, la sédentarité et le sommeil chez les enfants de moins de 5 ans. Organisation mondiale de la Santé. https://apps.who.int/iris/handle/10665/331751

Palma Chillón, Francisco B Ortega, Jose Antonio Ferrando, Jose Antonio Casajus (2017). Physical fitness in rural and urban children and adolescents from Spain DOI: 10.1016/j.jsams.2011.04.004

Pedro F Saint-Maurice, Diarmuid Coughlan, Scott P Kelly, Sarah K Keadle, Michael B Cook, Susan A Carlson, Janet E Fulton, Charles E Matthews. (2019). Association of Leisure-Time Physical Activity Across the Adult Life Course With All-Cause and Cause-Specific Mortality. JAMA Netw Open. DOI: 10.1001/jamanetworkopen.2019.0355

S Frayon, S Cherrier, Y Cavaloc, G Wattelez, Y Lerrant, O Galy (2018). Relationship of body fat and body mass index in young Pacific Islanders : a cross-sectional study in European, Melanesian and Polynesian groups, Pediatr Obes ;13(6) :357-364. DOI : 10.1111/ijpo.12229

S L Gortmaker 1, A Must, A M Sobol, K Peterson, G A Colditz, W H Dietz(1996). Television viewing as a cause of increasing obesity among children in the United States, 1986-1990. Arch Pediatr Adolesc Med ;150(4) :356-62 DOI : 10.1001/archpedi.1996.02170290022003

Saint-Maurice, P. F. (2019). Association of Leisure-Time Physical Activity across the Adult Life Course with All-Cause and Cause-Specific Mortality. Journal of the American Medical Association.

Shyama Choudhary, Satyendra Khichar, Dhanraj Dabi,Manish Parakh, Pawan K. Dara, Poonam Parakh,Suyasha Vyas, and Bindu Deopa(2016). Urban Rural Comparison of Anthropometry and Menarcheal Status of Adolescent School Going Girls of Jodhpur, Rajasthan, India . J Clin Diagn Res. 10(10) doi: 10.7860/JCDR/2016/21882.8757

Sofien Regaieg 1, Nadia Charfi 1, Mouna Elleuch 1, Fatma Mnif 1, Rim Marrakchi 2, Sourour Yaich 3, Kamel Jammousi 2, Jamel Damak 3, Mohamed Abid 1 (2015) [Obesity, physical activity and sedentary time among school adolescents aged 15 to 18 years in the city of Sfax (Tunisia)]. Pan Afr Med J DOI : 10.11604/pamj.2015.22.370.6121

Tremblay MS., Aubert S., Barnes JD., Saunders TJ., Carson V., Latimer-Cheung AE., et al. (2017). "Sedentary Behavior Research Network (SBRN) – Terminology Consensus Project process and outcome". Int. J. Behav. Nutr. Phys. Act. Observatoire national de l'activité physique et de la sédentarité [Internet]. [cited 2020 Feb 14]: http://www.onaps.fr/boite-outils-et-ressources/definitions

WHO Consultation on Obesity (1997 : Geneva, Switzerland) & World Health Organization. (2003). Obésité : prévention et prise en charge de l' épidémie mondiale : rapport d' une consultation de l' OMS. Organisation mondiale de la Santé. https://apps.who.int/iris/handle/10665/42734

****