



ISSN: 0976-3376

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

ASIAN JOURNAL OF  
SCIENCE AND TECHNOLOGY

Asian Journal of Science and Technology  
Vol. 17, Issue, 02, pp. 14167-14170, February, 2026

## RESEARCH ARTICLE

# EFFECTS OF PLAYING AQUATIC "LIPATO" ON BODY COMPOSITION AND BLOOD PRESSURE VALUES IN HIGH SCHOOL STUDENTS

ALONGO Yvon Rock Ghislain<sup>1,2</sup>, AMBETO Aimé Simplicite Christophe<sup>2</sup>, MOUSSOUAMI Simplicite Innocent<sup>1,2</sup>, ITOUA ONIANGUE ASSOBA Kiel OBELA IBATA Gency Reussi<sup>2</sup> and Espoir AMPA Raoul<sup>3</sup>

<sup>1</sup>Laboratory of Exercise Physiology and Biomechanics; <sup>2</sup>Higher Institute of Physical Education and Sport (ISEPS) Marien NGOUABI University, Brazzaville-Congo; <sup>3</sup>Faculty of Science and Technology

### ARTICLE INFO

#### Article History:

Received 19<sup>th</sup> November, 2025

Received in revised form

27<sup>th</sup> December, 2025

Accepted 08<sup>th</sup> January, 2026

Published online 27<sup>th</sup> February, 2026

#### Key words:

Practice, "lipato" game, Body Composition and blood pressure values.

### ABSTRACT

In response to the alarming rise in obesity and hypertension among young people, this study aimed to evaluate the effects of regularly playing the traditional game "Lipato" as an extracurricular activity on the body composition and blood pressure of students in rural areas. The study was conducted on a sample of 64 students aged 18 to 22, divided into two equal groups: an experimental group (EG) that participated in a "Lipato" playing program for 12 weeks during the school holidays, and a control group (CG) that received no intervention. Anthropometric measurements, body composition (BMI, muscle mass, body water), and blood pressure (maximum heart rate, mean arterial pressure) were recorded before and after the protocol. The results showed significant improvements in the EG compared to the CG: reduced weight and BMI, and increased muscle mass and body water. A notable decrease in maximum heart rate and mean arterial pressure was also observed. Regular practice of the game "Lipato" contributes to improving students' physical and cardiovascular health. Integrating this game into extracurricular activity programs or during school holidays could represent an effective strategy for preventing obesity and hypertension in rural schools.

**Citation:** ALONGO Yvon Rock Ghislain et al. 2026. "Effects of Playing aquatic "Lipato" on body composition and blood pressure values in high school Students", *Asian Journal of Science and Technology*, 17, (02), 14167-14170.

Copyright©2026, ALONGO Yvon Rock Ghislain et al. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

## INTRODUCTION

Movement is at the heart of life, defined as a change of position in space over time (Camargo, 2020). At school, physical education and sports (PES) play a vital role in students' development, mobilizing their motor skills for their overall well-being. Among the forms of motor activity, traditional sports, which Parlebas describes as "flexibly codified games," offer a wealth of educational value. Originating from local cultures, these games, such as hopscotch, dodgeball, and tag, promote physical, cognitive, and social development. Historically, in secondary schools, the practice of these games initially developed freely, in the absence of formal supervision. As early as 1791, Charles-Maurice de Talleyrand-Périgord recognized the importance of games during recess for strengthening the body. These traditional practices, although informal, have therefore always had a fundamental educational function in the school environment. Thus, in many countries, we find similar games whose rules vary according to local cultures. For example, hopscotch is played in western suburbs as well as in the dusty markets of India, Nepal, Burma, China or even Russia (Jacques B., 1762). In rural Congo, children engage in various extracurricular activities, notably the traditional game of "Lipato," very popular during the holidays. This endurance game with an aerobic component is perceived as a simple pastime providing pleasure and relaxation. However, the young people who play it are often unaware of its beneficial physiological effects.

Conversely, in urban areas, the increase in sedentary behavior linked to overexposure to screens (television, video games, smartphones, etc.) contributes to the rise in overweight and obesity among young people (Gort Maker SL, 2005). In 2020, a study revealed that the risk of cardiovascular disease was significantly lower in subjects with good aerobic fitness compared to those with low capacity. However, the difference in risk between the most physically active and least active individuals was less pronounced (Maude G., 2020). Furthermore, several social practices, though rarely integrated into school curricula, are regularly used by children and play a vital role in their physical development. One such example is "Lipato," a traditional Congolese game based on motor skills. It involves dynamic sequences of running, chasing, accelerating, braking, feinting, and changing direction. This game is widely played, particularly in rural areas, and represents a natural educational and motor skills tool, yet it is still undervalued in the school setting. The World Health Organization (WHO) and UNICEF have recently made combating sedentary behavior in children a global priority (Clark H., 2020). Indeed, while moderate to vigorous physical activity corresponds to an energy expenditure of between 3 and 9 METs, sedentary behavior is defined as an energy expenditure of less than 1.6 METs per day (Tremblay MS., 2020). According to WHO recommendations, children aged 5 to 17 years should engage in at least 60 minutes of moderate to vigorous physical activity daily ( $\geq 3$  METs) to prevent the accumulation of visceral fat and pathologies related to hypertension.

In this context, Tiémoré (2025) notes that in some educational systems, games were integrated into teaching as effective means of physical development. However, in the Congolese context, extracurricular physical activities are still undervalued, particularly in rural areas, often due to parents' lack of awareness of their beneficial effects on children's health. Yet, these activities can play a vital role in combating non-communicable diseases such as obesity and hypertension. Faced with this reality, a central question arises: can extracurricular activities based on the traditional game of " Lipato " induce beneficial physiological adaptations in students, particularly in terms of body composition and blood pressure regulation? Our prospective study aims to answer this question.

**Two specific questions arise from this:**

- What are the effects of playing the "Lipato" game on body composition variables in school children? What are its effects on blood pressure values during the holiday period?

Based on these questions, we formulate the following hypotheses: Regular practice of the "Lipato" game leads to significant changes in the students' body composition. This activity also contributes to stabilizing blood pressure in these children. Thus, the " Lipato " game would promote both improved body composition and blood pressure regulation, particularly in the subjects of the experimental group.

Congo, specifically in the area of the "Lobi" river (Likouala-Mossaka). This site was chosen because of the traditional practice of the water game "lipato", offering a suitable setting for observation and the collection of reliable and representative data.

**Participants:** The target population consisted of adolescents from the Makoua district, with an average age of 21. A random sample of 64 subjects, equally divided into two groups (32 experimental and 32 control), was selected according to strict inclusion and exclusion criteria. Young men aged 19 to 22 years who practiced the game of " lipato " in an aquatic environment were included. Those who did not complete the three-month practice period during the experimental phase were excluded.

**Experimentation procedure**

**Equipment:** The equipment used for this study consisted of: a two (2) meter Stanley measuring rod for measuring height; an Omron (EU) bathroom scale calibrated in kilograms (kg) for measuring weight; and a Tanita body composition analyzer.BC-545 FITSCAN for the assessment of body composition variables; a sphygmomanometer to assess blood pressure values before and after the intervention; individual data collection forms.

**Variables:** The independent variables are: age; size and weight, The dependent variables are: body composition variables are: percentage

**Table 1. The physical conditioning training program for participants is 2 hours and thirty minutes per day, at least four times per week**

	Teaching strategies	Dosage and volume	Assessment
Warm-up Duration: 30 min	Chase game (cat and mouse, distance 1m then 2m. Apnea game (filling a water bottle)	4 times each 4 times each	Perform at least 2 times
Main section Duration : 1 hour 30 minutes	Lipato " sequences (chases with cat-and-mouse action)	4 Series for 10-15 year olds	Group of ten sessions each group
Calm returns Duration: 30 minutes	Relaxation through aquatic floating and breath-holding	Series of 1 to 2 minutes	FloatInhale and exhale

**Table 2. Represents the anthropometric variables of the study sample in the form of mean plus or minus standard deviation**

Anthropometric variables	GE (n=32)		P
	Before	After	
Age (years)	21.06 ± 1.95	21.06 ± 1.95	NS
Size (cm)	1.67±0.08	1.67±0.08	NS
Weight (kg)	69.80±4.45***	66.80±4.27	<0.001
BMI (kg/ m <sup>2</sup> )	23.19±1.53***	21.77±2.57	<0.001

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

**Table 3. Shows the comparison of the means of "body composition" between pre and post-exercise of the experimental group in the form of mean plus or minus standard deviation**

Body composition	GE (n=32)		P
	Before	After	
MM (%)	46.80±4.45***	48.74±4.71	<0.001
BMI (kg/ m <sup>2</sup> )	24.19±1.53***	22.77±2.57	<0.001
MH (%)	59.42±4.32***	62.27±3.44	<0.001
MG (%)	18.80±4.45***	14.74±4.71	<0.001

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

**Table 4. Shows the comparison of the average "tension values" between pre and post-exercise on the second day in the form of average plus or minus standard deviation**

Blood pressure values	GE (n=32)		P
	Before	After	
FC max (bt /min)	98.09±19.57	83.78±9.42	< 0.05
PAS (mm Hg)	129.38±24.95	128.72±12.50	NS
PAD (mm Hg)	84.34±30.32	72.22±17.44	< 0.05
MAP (mm Hg)	99.09±19.57	72.71±14.57	< 0.05

Abbreviations: HR max: maximum heart rate; SBP: systolic blood pressure; DBP: diastolic blood pressure; MAP: mean arterial pressure and GE: experimental group.

## METHODOLOGY

### Type of study, period and scope of intervention

This experimental study was conducted from July 4 to September 28, 2024 in the rural district of Makoua, in the north of the Republic of

Congo, specifically in the area of the "Lobi" river (Likouala-Mossaka). This site was chosen because of the traditional practice of the water game "lipato", offering a suitable setting for observation and the collection of reliable and representative data.

% of fat, muscle mass, BMI and water mass and blood pressure values: blood pressures including systolic (SBP), diastolic (DBP) and mean (MAP), obtained from the formula: MAP = (SBP + 2 × DBP) ÷ 3.

**Intervention Program:** Height and weight were used to calculate the body mass index (BMI), obtained by dividing weight (kg) by height

(m) squared. This index assesses the subject's overweight or nutritional status, according to the WHO classification.

**Statistical Analysis:** Data were analyzed using SPSS 23.0 software. Quantitative variables are presented as means  $\pm$  standard deviations. A paired Student's t-test was used to compare means before and after the intervention within each group. An unpaired t-test was used to compare the experimental and control groups. The significance level was set at  $p < 0.05$ . All participants provided informed consent, in accordance with the Declaration of Helsinki.

## RESULTS

Table 2 indicates that, in the experimental group, weight and BMI significantly decreased after the intervention ( $p < 0.001$ ), while age and height remained unchanged. This table shows a significant change in body composition in the experimental group after exercise. There was an increase in muscle mass (MM) and water mass (MH), as well as a decrease in BMI and fat mass (FM), all of which were highly statistically significant ( $p < 0.001$ ). Table 4 shows a significant improvement in blood pressure values in the experimental group between before and after exercise. A significant decrease in maximum heart rate, diastolic blood pressure (DBP), and mean arterial pressure (MAP) was observed ( $p < 0.05$ ), indicating a positive effect of the lipato game on cardiovascular adaptation. Systolic blood pressure (SBP), on the other hand, remained stable.

**Table 5. Comparison of anthropometric variables of the two groups**

Anthropometric variables	GE (n=32)	GT (n=32)	P
	After	After	
Age (years)	21.06 $\pm$ 1.95	21.03 $\pm$ 1.636	NS
Size (cm)	1.67 $\pm$ 0.08	1.66 $\pm$ 0.08	NS
Weight (kg)	66.80 $\pm$ 4.27	69.90 $\pm$ 3.89	<0.05
BMI (kg/m <sup>2</sup> )	21.77 $\pm$ 2.57	25.41 $\pm$ 1.39	<0.05

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

This table indicates that the two groups are comparable in age and height (no significant difference). However, the experimental group has a significantly lower weight and BMI than the control group ( $p < 0.05$ ).

**Table 6. Comparison of body composition variables between the control group and the experimental group**

Body composition	GE (n=32)	GT (n=32)	P
	After	After	
MM (%)	48.74 $\pm$ 4.71	42.97 $\pm$ 3.89**	<0.01
BMI (kg/m <sup>2</sup> )	21.77 $\pm$ 2.57	23.41 $\pm$ 1.39*	<0.05
MH (%)	62.27 $\pm$ 3.44	52.35 $\pm$ 3.60***	<0.001
MG (%)	14.74 $\pm$ 4.71	18.97 $\pm$ 3.89**	<0.01

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

The results in Table 6 clearly show that the experimental group that played the lipato game exhibited a significant improvement in body composition compared to the control group. An increase in muscle and water mass was observed, as well as a decrease in fat mass and BMI.

**Table 7. Comparison of the means of the tension variables between the two groups**

Tension variables	GT(n=32)	GE (n=32)	P
	After	After	
FC max ( bt /min)	113.44 $\pm$ 12.75**	83.78 $\pm$ 9.42	<0.01
PAS (mm Hg)	129.01 $\pm$ 19.57	128.72 $\pm$ 12.50	NS
PAD (mm Hg)	89.38 $\pm$ 24.95	72.22 $\pm$ 17.44	NS
MAP (mm Hg)	99.34 $\pm$ 30.32**	72.71 $\pm$ 14.57	<0.01

**Abbreviations:**HR max: maximum heart rate; SBP: systolic blood pressure; DBP: diastolic blood pressure; MAP: mean arterial pressure; GE: experimental group and GT: control group.

This table shows a significant decrease in maximum heart rate and mean arterial pressure in the experimental group. This reflects improved cardiovascular adaptation through the practice of the lipato game. Although systolic and diastolic blood pressure are not significantly different, their decrease remains beneficial.

## DISCUSSION

This study provides data on body composition, blood pressure values and certain anthropometric variables in rural students practicing the game of lipato.

**Anthropometric values:** The study shows stable age and height in both groups, but significant differences in weight and BMI favoring the experimental group at the end of the intervention, attributable to playing the lipato game. This is explained by the fact that all physical activity induces physiological adaptations. Our results are consistent with those of Bachelor (2017), showing that high training volumes ( $\geq 200$  min/week) promote weight loss, especially aerobic weight loss. The BMI observed in our subjects remained within the WHO (2007) guidelines, reflecting good nutritional status. This indicates that obesity and overweight are often linked to a sedentary lifestyle and low levels of physical activity. Consequently, recent studies indicate that sedentary behaviors, such as excessive screen time (television, video games, internet, and mobile phones), contribute significantly to the rise in overweight among children and adolescents (Gortmaker, 2005). However, our research focused on a rural population. According to Chillon (2017), these differences are explained in particular by lifestyle, which influences body composition and physical condition. Urbanization and modernization, while associated with socioeconomic development, promote less active behaviors, thus increasing the risk of obesity (Coudrary, 2016). Other factors, such as socioeconomic status and eating habits, particularly breakfast consumption among boys, are also associated with overweight (Frayon, 2017). The significant decrease in BMI observed after exercise is linked to a reduction in fat mass. A high basal metabolic rate, combined with high lipid oxidation, promotes long-term weight control. Thus, physical exercise appears to be an effective tool in the prevention and control of childhood obesity, as highlighted by Zurlo (1990).

**Body composition values of practitioners:** The results show a significant improvement in muscle mass and a highly significant increase in body water percentage in the experimental group compared to the control group, highlighting the beneficial effects of this physical activity. These results are explained by a greater accumulation of adipose tissue in the control group, contrasting with the lean mass of the experimental group. In the latter, bone tissue represents approximately 14.9% of body weight, while fat reserves are more pronounced in the control group (McArdle et al., 2001). Regular practice of the lipato game appears to have promoted better body composition, as evidenced by the significant improvements observed from the first day post-exercise in the experimental group, particularly in muscle mass, BMI, and hydration. This high significance confirms the beneficial effects of physical activity on body composition, particularly through the reduction of BMI and fat mass, and the improvement of hydration. Therefore, regular participation in extracurricular activities such as playing lipato, especially during school holidays, is an effective strategy for preventing overweight, a risk factor for childhood obesity and various associated health problems. These results are consistent with those of Bachelor et al. (2017), according to which regular and well-structured physical activity, including endurance and muscular resistance, promotes the reduction of fat mass and the maintenance or increase of lean mass. However, the majority of overweight adolescents are relatively inactive and have low spontaneous participation in physical activities. Our results differ from those of Scoubeau C (2020), who studied five patients with type 1 diabetes (T1D), thirteen with type 2 diabetes (T2D), and five healthy subjects (HCS) who underwent a 12-week training program. Recent WHO recommendations in 2020 emphasize that adolescents should replace time spent sitting or in front of screens with at least 60 minutes of moderate- to vigorous-

intensity physical activity daily, while maintaining sufficient sleep, in order to reap positive health benefits. Physical inactivity is a major cause of death worldwide and contributes to the rise in overweight and obesity. If our intervention lasted four months, our results would align with those of Yan et al. (2025), who demonstrated a significant reduction in body composition among obese Tunisian boys and girls aged 18 to 23 years following a physical activity program of this duration. Aerobic fitness, while partly genetic, can be improved through exercise, thereby reducing mortality (Blair, 1995). Increasing physical activity levels is always beneficial: some is better than none, and more is even better (Rasmussen, 2018; Saint-Maurice, 2019). Even active individuals can improve their health by increasing and diversifying their physical activities. There is no minimum threshold below which activity has no positive effect (Kino-Québec, 2020).

**Blood pressure values of the participants:** The results show a highly significant difference between the experimental and control groups for maximum heart rate and mean arterial pressure, with the experimental group showing a higher difference. In contrast, systolic and diastolic blood pressure did not differ significantly. The increased maximum heart rate in the experimental group is attributed to improved ventilation during the lipato game. These changes observed after exercise are physiological adaptations. Physical activity, through the lipato game, significantly improves blood pressure values (systolic, diastolic, and mean arterial pressures), thus strengthening the cardiorespiratory system and contributing to the prevention of hypertension. After recovery, these values stabilize in the experimental group. These results confirm those of Xavier Clamidet (2006), highlighting that regular physical activity is effective in moderately reducing blood pressure, with significant benefits at the population level. Increasingly, researchers are highlighting the benefits of low-intensity physical activity for heart and metabolic health, reducing the overall risk of mortality (Fuzeki, 2017). However, moderate to high-intensity exercise offers greater cardiovascular and metabolic benefits by mobilizing visceral adipose tissue and ectopic fat, even without weight loss (Boutchier, 2010). Regular physical activity in adolescents is beneficial, particularly for reducing body fat and regulating blood pressure. It decreases overall and cardiovascular mortality, as well as morbidity related to chronic diseases. A meta-analysis shows that physical activity three times a week reduces blood pressure, especially in hypertensive individuals. Endurance exercise reduces blood pressure (BP) by 5 to 7 mmHg in hypertensive individuals, regardless of weight loss. This benefit results from improved cardiac adaptation, enhanced vasodilation, and a decrease in sympathetic tone. Moderate muscle strengthening also lowers BP by 3 to 4 mmHg and is not contraindicated. These effects are only sustained with regular and prolonged activity. Exercise also protects against the development of hypertension.

**Limitations of the study:** Our results do not take into account certain parameters such as sleep quality and the subjects' energy expenditure. However, these limitations did not impact our conclusions.

## CONCLUSION

Our study assessed the impact of the Lipato game on students' body composition and blood pressure during the holidays. The results confirm that this physical activity promotes positive changes, reducing the risk of obesity and stabilizing blood pressure, thus contributing to the prevention of hypertensive diseases. The integration of extracurricular activities, such as Lipato, is therefore essential for improving students' physical health. Despite some limitations, it would be worthwhile to extend this research by including energy expenditure and sleep quality over a longer period (12-14 weeks). Combating physical inactivity remains a major global public health challenge.

**Applicable notes:** This study provides important information to encourage students to engage in endogenous activities during the holidays to maintain their motor skills and cardiovascular health. This study also allows students and physical education teachers to take into account the practical references for Integrate in motor learning.

**Author contributions:** Project design and development: Alongo Yvon Rock Ghislain, Data acquisition: Obela Ibata Gency Reussi, Data Analysis and Interpretation: Ambeto Aimé Simplicie Christophe, Manuscript Writing: Moussouami Simplicie Innocent, Critical Review for Significant Intellectual Content: Alongo Yvon Rock Ghislain, Statistical Analysis: Ambeto Aimé Simplicie Christophe, Administrative, Technical and Material Support: Itoua Oniangue Assoba Kiel; Study Supervision; Ampa Raoul.

**Conflict of interest:** The authors mention that there is no "Conflict of interest" in this study.

## REFERENCES

- Bachelor, C. J. (2017). Impact de l'activité physique sur la perte de poids de personnes en surpoids ou obèses.
- Blair, S. N. (1995). Changes in Physical Fitness and All-Cause Mortality. A Prospective Study of Healthy and Unhealthy Men. *Jama*.
- Boutchier, S. (2010). High-Intensity Intermittent Exercise and Fat Loss (éd. Journal of obesity, vol. 2011).
- Camargo, V. S. (2020). Développement de la motricité humaine dans les cours d'éducation physique en tant que stratégies pédagogiques.
- Charles-Maurice, T. (1791). Rapport sur l'instruction publique fait au nom du Comité de Constitution. Les 10, 11, 19 septembre 1791, Paris, Imprimerie de Baudouin, pp. 116-117.
- Chillon, P. O. (2017). Physical fitness in rural and urban children and adolescents from Spain (Vol. Vol. 14, n° 5). *Journal of Science and Medicine in Sport*.
- Xavier Clamidet, X. (2006). activité physique dans le traitement de l'hypertension artérielle.
- Clark H., C.-S. A. (2020). A future for the world's children. A who- Unicef-Lancet Commission. *The Lancet*.
- Coudrary, S. K. (2016.). Urban Rural Comparison of Anthropometry and Menarcheal Status of Adolescent School Going Girls of Jodhpur, Rajasthan, India (éd. DOI 10.7860/JCDR/2016/21882.8757). *Journal of clinical and diagnostic research: JCDR*.
- Frayon, S. C. (2017). Relationship of body fat and body mass index in young Pacific Islanders: a cross-sectional study in European, Melanesian and Polynesian groups: Body fat and BMI in Pacific Islanders (éd. *Pediatric Obesity*). (D. 10.1111/ijpo.12229, Éd.)
- Fuzeki, E. E. T. (2017). Health Benefits of Light-Intensity Physical Activity: A Systematic Review of Accelerometer Data of the National Health and Nutrition Examination Survey NHANES éd. *Sports Medicine*, vol. 47, n° 9.
- Gortmaker SL, M. A. (2005). television viewing as a cause of increasing obesity among children in the United States 1986-1990. *Arch Pediatr Adolesc Med*; 150 (4): 354-62. G. f. Form, Éd.
- Jacques, B. (1762). Dissertation sur l'éducation physique des enfants, depuis leur Naissance jusqu'à l'âge de la puberté.
- Kino-Québec, C. s. (2020). Pour une population québécoise physiquement active : des recommandations / Savoir et agir, Québec, Ministère de l'Éducation et de l'Enseignement supérieur, Direction du sport, du loisir et de l'activité physique.
- 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 (2020).
- Rasmussen, M. G. (2018). Changes in Cycling and Incidence of Overweight and Obesity among Danish Men and Women. *Medicine and science in sports and exercise*.
- 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*.
- Scoubeau C, F. V. (2020). Impact de l'activité physique sur la composition corporelle, la graisse viscérale et la condition physique en fonction du type de diabète.
- Tremblay MS., A. S.-C. (2020). Observatoire national de l'activité physique et de la sédentarité.
- Zurlo F, L. S. (1990). Low ratio of fat to carbohydrate oxidation as predictor of weight gain: study of 24-h RQ. (*A. J. Physiol*, Éd.)