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Original article

Activities to improve nutritional status and motor coordination in students between 8 and 12 years' old

Actividades para mejorar el estado nutricional y la coordinación motriz, en estudiantes entre 8 y 12 años

Atividades para melhorar o estado nutricional e coordenação motora, em alunos entre 8 e 12 anos

Mario Danilo Mora Mora[1*], *Reinaldo Alberto Pardo Raak*[1*], *Damaris Hernández Gallardo*[2*], *Giceya de la Caridad Maqueira Caraballo*[1*]

[1*] Universidad Bolivariana del Ecuador

[2*] Universidad Laica Eloy Alfaro de Manabí

Corresponding author: mdmoram@ube.edu.ec

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ABSTRACT

Nutritional status is a determining factor in health, and several studies link it to motor skills. The aim of the article was to propose a group of activities to improve motor coordination and nutritional status in students from the Ecuadorian coastal region. The study was carried out based on observation of different tests, objectively evaluated from the skills expressed in seven consecutive tasks and without intermediate rest, the dynamic motor condition, visual-motor and general coordination in students were evaluated. As a result, the sample under study presented a general condition of normal height and prevalence of normal weight, although with a significant number of students with excess weight, as well as an inadequate development of motor coordination, particularly of the visual-motor type; it was demonstrated that the coordinated activities carried out systematically favored the unity of the group inside and outside the class, and the proposed games were the appropriate context to improve coordination based on healthy nutrition

Keywords: physical activity, students, motor skills, healthy nutrition

RESUMEN

El estado nutricional es determinante en la salud, y diversos estudios lo vinculan con la motricidad. El objetivo del artículo consistió en proponer un grupo de actividades para mejorar la coordinación motriz y el estado nutricional en estudiantes de la región costa ecuatoriana. El estudio se realizó sobre la base de la observación a diferentes pruebas, evaluadas de modo objetivo desde las habilidades expresadas en siete tareas consecutivas y sin descanso intermedio, se evalúo la condición dinámica motriz, viso-motor y la coordinación general en los estudiantes. Como resultado la muestra en estudio presentó una condición general de talla normal y prevalencia de normopeso, aunque con un número significativo de estudiantes con exceso ponderal, así como un inadecuado desarrollo de la coordinación motriz, en particular la de tipo viso-motor; se demostró que las actividades coordinadas y realizadas de forma sistemática favorecieron la unidad del grupo dentro y fuera de la clase, y los juegos propuestos fueron el contexto propicio para mejorar la coordinación basada en la nutrición saludable.

Palabras clave: actividad física, estudiantes, motricidad, nutrición saludable

RESUMO

O estado nutricional é um fator determinante na saúde e vários estudos o relacionam com as habilidades motoras. O objetivo do artigo foi propor um conjunto de atividades para melhorar a coordenação motora e o estado nutricional em estudantes da região costeira equatoriana. O estudo foi realizado a partir da observação de diferentes testes, avaliados objetivamente a partir das habilidades expressas em sete tarefas consecutivas e sem descanso intermediário, foram avaliadas a dinâmica motora, a condição viso-motora e a coordenação geral nos alunos. Como resultado, a amostra em estudo apresentou um estado geral de estatura normal e prevalência de peso normal, embora com um número significativo de alunos com excesso de peso, bem como um desenvolvimento inadequado da coordenação motora, particularmente do tipo viso-motor; Foi demonstrado que as atividades coordenadas e realizadas de forma sistemática favoreceram a unidade do grupo dentro e fora da turma, e os jogos propostos foram o contexto propício para melhorar a coordenação baseada na alimentação saudável.

Palavras-chave: atividade física, estudantes, habilidades motoras, alimentação saudável

INTRODUCTION

The school condition represents a social state of subjects subject to an institutionalized teaching-learning process, and includes individuals in different states of biological maturity that require functional stimulation generated by physical activity and adequate nutrition, both incidents in a progressive progress and development of basic motor skills (Hurtado, et al., 2023) reflected in nutritional status (Martínez, et al., 2019).

In the case of children, nutritional status has been significantly related to health (Antoniazzi, et al., 2018); it has been pointed out that overweight causes the development of risk factors in the psychological, biological and social fields, and leads to isolation, decreased

self-esteem and body self-perception, reflected in interpersonal relationships in all areas of action; in addition to the appearance of different diseases such as orthopedic, respiratory, cutaneous, arterial hypertension, elevated plasma lipids, insulin resistance and type 2 diabetes mellitus (Ferrer, et al., 2019), and influences cognitive development (Calceto, et al., 2019), as well as the physical and intellectual performance of the individual (Saintila , 2020; Delgado, et al., 2019).

However, a nutritional status deteriorated by food limitations causes physical problems that, from hidden hunger associated with micronutrient deficiencies and macronutrient intake, lead to delayed learning, cognitive limitations and the ability to develop maximum potential in new generations, including motor coordination (Herlitz , et al., 2021).

Motor coordination is the result of coordinative abilities, which unlike conditional ones, are formed in a learning context, mediated by nutritional support and adequate psychomotor stimulation (Vega, et al., 2016), and favors the execution of practically all activities of daily life; thus, an approach to its definition was presented by Rigal (2006) who associates it with the result or consequence of a complex activity, which can be intellectual or physical.

For Cenizo et al. (2017), it represents the capacities that organize and regulate the partial processes of a motor act, based on a pre-established objective, and Hernández et al. (2023) associates its execution with the intimate relationship between the brain and the motor action, based on a specific objective and the conjunction of precision and a given level of coordination of one or more activities in unison, criteria supported by Liendo et al. (2023) and Herlitz et al. (2021) who in general terms conceive it from the interaction of the nervous system and the osteomyoarticular functional apparatus in an economical way, in the solution of motor problems with the participation of various body segments.

Therefore, motor coordination implies an adequate nutritional base and the application of learned psychomotor procedures, both from instruction and education, which lead to the use of knowledge, the adoption of attitudes, the development of character, feelings and acceptance of a lifestyle in the field of socialization of the individual, where physical exercises stimulate the initiative to achieve desired results and thus face everyday problems,

with the use of highly complex mental actions, in the order of knowing how to plan, organize, and even evaluate behavior, hence the meaning of Physical Education in the school environment, as well as playful stimulation and moderate or active physical activity, in the context of the home and the community (Sanz, 2019).

Based on the above and given the interest in changing this state of affairs, the objective was to evaluate the nutritional status and motor coordination in students from the Ecuadorian coastal region.

MATERIALS AND METHODS

The presented research had a non-experimental, correlational, descriptive and cross-sectional quantitative approach. It was carried out at the "Galo Plaza Lasso" urban basic general school, a regular education and fiscal support center, under the coastal school regime, located in the city of Machala, canton of the same name, El Oro province, located in the southern region of the coast of Ecuador.

As a population, 756 students were selected, distributed in seven levels of education and ages between 8 and 12 years; and the sample, with an intentional non-probabilistic character, was 433 students from levels 4 to 7, which was finally reduced to 404 subjects distributed by sex in 194 females (48%) and 210 males (52%). The conditions considered were the acceptance of participation in the study, through the signature of the consent by parents or guardians; the assent of the students, the participation in the application of the motor coordination tests; and not presenting any physical disability or being subjected to therapeutic treatment of nutritional food type (Table 1).

Table 1. *Study population according to educational level and sex*

		Level of Education								Total	
		Fourth level		Fifth level		Sixth level		Seventh level			
		8-9 years		9-10 years		10-11 years		11-12 years			
		Subtotal	%	Subtotal	%	Subtotal	%	Subtotal	%	Total	%
Se	Women	44	10.9	57	14.1	51	12.6	42	10.4	194	48.0

	Men	43	10.6	58	14.4	46	11.4	63	15.6	210	52.0
Total		87	21.5	115	28.5	97	24.0	105	26.0	404	100.0

Anthropometric measurements were taken: height (T, m) and weight (P, kg) using the international anthropometric protocol (FAO/WHO/UNO, 1985; Marfell , et al., 2015), height with a SECA 206 portable vertical stadiometer with a range of 0220 cm and 1 mm of precision, and weight using the Tanita scale InnerScanV Model: BC545N and precision of 0.1 kg, the determination of these variables allowed to calculate the body mass index (BMI) according to the equation proposed by WHO/FAO/UNU, (1985). The anthropometric variables were analyzed individually and by age and sex strata according to the WHO curves of weight/age, height/age and BMI/age, from 5 to 19 years.

The motor condition of the sample was determined with the test proposed by Cenizo et al. (2017) aimed at diagnosing general dynamic coordination (CDG in Spanish) and visual-motor coordination (VMC), through qualitative procedures, based on the observation of the students in different objectively evaluated tests, from the skills that were expressed in seven consecutive tasks, without intermediate rest, which showed a different type of coordination, applied according to the following scheme (Figure 1).

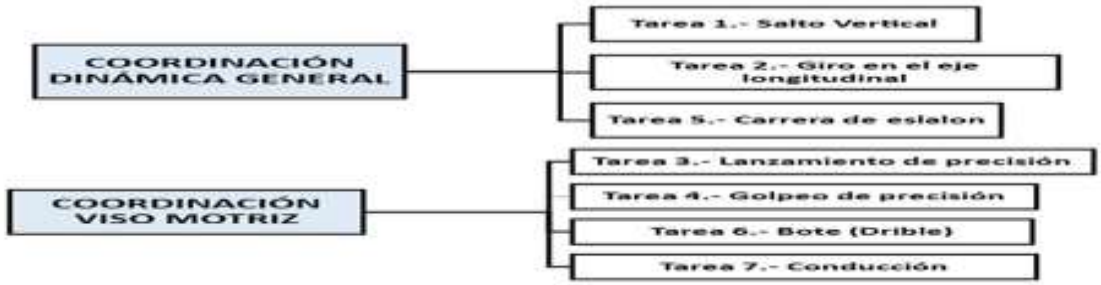

Figure 1. *Distribution of tasks for the diagnosis of general dynamic and visual-motor coordination*

The test was applied in the Physical Education area of the center, following the guidelines (Cenizo, et al., 2017), individual tasks were graded according to the scales proposed by them, and those that contributed to each of the coordination modes were grouped together by means of a summative index, obtained from the median of the results to establish a rating, according to a percentile scale in which individuals with values lower than the median,

percentile 50, are evaluated as deficient; those located at the median value of regular, located in the 75th percentile, of good; and those that exceed it of excellent. This same procedure was used to combine the grades obtained by the subjects participating in the CDG and CVM, and to evaluate general motor coordination (CMG in Spanish).

Statistical analysis was performed using SPSS version 27.0, determining as descriptive statistics the arithmetic mean (M), standard deviation (SD), presented as M (SD), and the coefficient of variation (CV%), in addition to the percentage values for the categorical variables within the descriptive statistics.

The normality of the data was verified with the Kolmogorov-Smirnov Z test and showed a non-normal statistical distribution. The contrast between variables was performed with the Mann-Whitney U statistic (Z), while Pearson's Chi square (X^2), Kruskal Wallis (k) and post hoc analysis performed with the Kruskal Wallis one-way ANOVA statistic for polytomous variables, on the other hand, the association of the variables of classification of the nutritional status with respect to the evaluations of the motor condition were determined by the Spearman correlation coefficient (Rho) at a confidence level of 95% (á = 0.05).

RESULTS

The age of the study population reached a M and SD of 9.55 (1.10) years, males (9.62 (.12) years) older than females (9.47 (1.07) years). On the other hand, the average height was 1.36; while the weight was 36.19 kg, with a progressive increase, according to age in both variables (Table 2), although without significant differences between sexes according to the U of Man Whitney , while the contrast of the different levels of education showed significant differences for height ($k = 213.331$; $p < 0.000$), but not for weight between sixth and seventh grade students ($k = -34.702$; $p > 0.209$). In all cases the CV% was found with values lower than 30% so the M was representative of the data set.

Table 2. *Anthropometric parameters by education level and sex.*

Level of Education	Sex	Anthropometric parameters					
		Size (m)		Weight (kg)		BMI	
		M(DE)	CV%	M(DE)	CV%	M(DE)	CV%
Fourth	Women	1.26(0.06)	4.8	27.87(6.11)	21.9	17.31(2.5)	14.8
	Men	1.27(0.05)	4.3	30.23(8.13)	26.9	18.44(3.84)	20.9
	Total	1.26(0.05)	4.5	29.04(7.24)	24.9	17.87(3.29)	18.4
Fifth	Women	1.33(0.05)	4.5	35.51(9.29)	26.2	19.88(4.31)	21.7
	Men	1.32(0.05)	4.3	32,32(7,4)	23	18.25(3.30)	18.1
	Total	1.32(0.05)	4.4	33.90(8.51)	25.1	19.06(3.90)	20.5
Sixth	Women	1.33(0.08)	5.8	35.51(10.55)	27	19.88(3.6)	18.8
	Men	1.37(0.06)	4.6	37.43(6.02)	16.3	19.62(2.84)	12.7
	Total	1.39(0.07)	5.3	38.3(8.72)	22.8	19.58(8.72)	16.1
Seventh	Women	1.44(0.08)	5.6	42.86(11.11)	25.9	20.23(4.07)	20.1
	Men	1.44(0.5)	3.9	42.50(11.26)	26.5	20,30(4,30)	21.5
	Total	1.44(0.06)	4.7	42.64(11.14)	26.1	20,27(11,14)	20.8

The values obtained for height/age as a descriptor of nutritional status allowed to determine that normal height predominated in the population under study (Table 3), only four cases (0.9%) of short stature corresponded to the fourth level, of which three were females and one male. On the other hand, according to weight/age, 71.3% were normal weight, of which 38.6% were females and 32.7% were males.

21.5% of the students were obese. The level of malnutrition was very low and was found in students in the fourth and fifth levels of schooling; however, the levels coincided in having a greater proportion of normal weight and lower levels of excess weight than in the rest, thus in the sixth level there was 33.0% of obese students, while in the seventh level there was 21.9% (Table 3).

The nutritional status classification according to BMI/age showed that 55.0% of the students were of normal weight , 19.6% were overweight and 18.6% were obese. 28 (6.9%) students were found to be underweight, among whom the females stood out (Table 3). By educational level, those with the best nutritional conditions were those of the fifth and seventh levels, where the greatest number of overweight students also appeared.

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Table 3. *Nutritional status of schoolchildren according to height, weight and BMI for age. Data are given in absolute frequency (f(x)) and percentage frequency (f(%)).*

Level	Sex	Frequency	Size/age			Weight/age					BMI/age				
			Severe chronic malnutrition	Standard size	Subtotal	Underweight	Normal weight	Overweight	Obesity	Subtotal	Severely underweight	Normal weight	Overweight	Obesity	Subtotal
4 to	Women	f(x)	3	41	44	4	39	0	1	44	8	19	16	1	44
		f(%)	3.40	47.10	50,60	4.6	44.8	0	1.1	50.6	9.2	21.8	18.4	1.1	50.6
	Men	f(x)	1	42	43	0	30	5	8	43	4	21	11	7	43
		f(%)	1.10	48.30	49.40	0	34.5	5.7	9.2	49.4	4.6	24.1	12.6	8	49.4
	Subtotal	f(x)	4	83	87	4	69	5	9	87	12	40	27	8	87
		F(%)	4.60	95.40	100.0	4.6	79.3	5.7	10.3	100	13.8	46	31	9.2	100
5 to	Women	f(x)	0	57	57	2	45	3	7	57	5	29	11	12	57
		F(%)	0	49.60	49.60	1.7	39.1	2.6	6.1	49.6	4.3	25.2	9.6	10.4	49.6
	Men	f(x)	0	58	58	0	40	5	13	58	0	40	7	11	58
		F(%)	0	50.40	50.40	0	34.8	4.3	11.3	50.4	0	34.8	6.1	9.6	50.4
	Subtotal	f(x)	0	115	115	2	85	8	20	115	5	69	18	23	115
		F(%)	0	100.0	100.0	1.7	73.9	7	17.4	100	4.3	60	15.7	20	100
6 to	Women	f(x)	0	51	51	34	2	15	51	51	4	20	13	14	51
		F(%)	0	52.6	52.6	35.1	2.1	15.5	52.6	100	4.1	20.6	13.4	14.4	52.6
	Men	f(x)	0	46	46	25	4	17	46	46	2	22	15	7	46
		f(%)	0	47.4	47.4	25.8	4.1	17.5	47.4	100	2.1	22.7	15.5	7.2	47.4
		f(x)	0	97	97	59	6	32	97	97	6	42	28	21	97

Level	Sex	Frequency	Size/age			Weight/age					BMI/age				
			Severe chronic malnutrition	Standard size	Subtotal	Underweight	Normal weight	Overweight	Obesity	Subtotal	Severely underweight	Normal weight	Overweight	Obesity	Subtotal
	Subtotal	F(%)	0	100.0	100.0	60.8	6.2	33.0	100.0	100.0	6.2	43.3	28.9	21.6	100
7mo	Women	f(x)	0	42	42	38	1	3	42	42	3	31	2	6	42
		f(%)	0	40.0	40.0	36.2	1	2.9	40	100	2.9	29.5	1.9	5.7	40
	Men	f(x)	0	63	63	37	3	23	63	63	2	40	4	17	63
		F(%)	0	60.0	60.0	35.2	2.9	21.9	60	100	1.9	38.1	3.8	16.2	60
	Subtotal	f(x)	0	105	105	75	4	26	105	105	5	71	6	23	105
		f(%)	0	100.0	100.0	71.4	3.8	24.8	100	100	4.8	67.6	5.7	21.9	100
TOTAL		f(x)	4	400	404	6	288	23	87	404	28	222	79	75	404
		f(%)	1.0	99.0	100.0	1.5	71.3	5.7	21.5	100	6.9	55	19.6	18.6	100

According to the performance in the tasks that contributed to the CDG (Figure 2), a high number of subjects were classified as deficient, with a predominance of the average evaluation. Regarding task 1 of vertical jump, females achieved better results, although the Chi square test ($X^2 = 6.075$; $p>0.108$) showed no significant differences, while according to the Kruskal Wallis test for the level of education, significant differences were revealed ($K= 7.536$; $p>0.000$) between the groups, and through the post hoc test, similarity could be detected between the fourth and sixth levels, and the fifth and seventh.

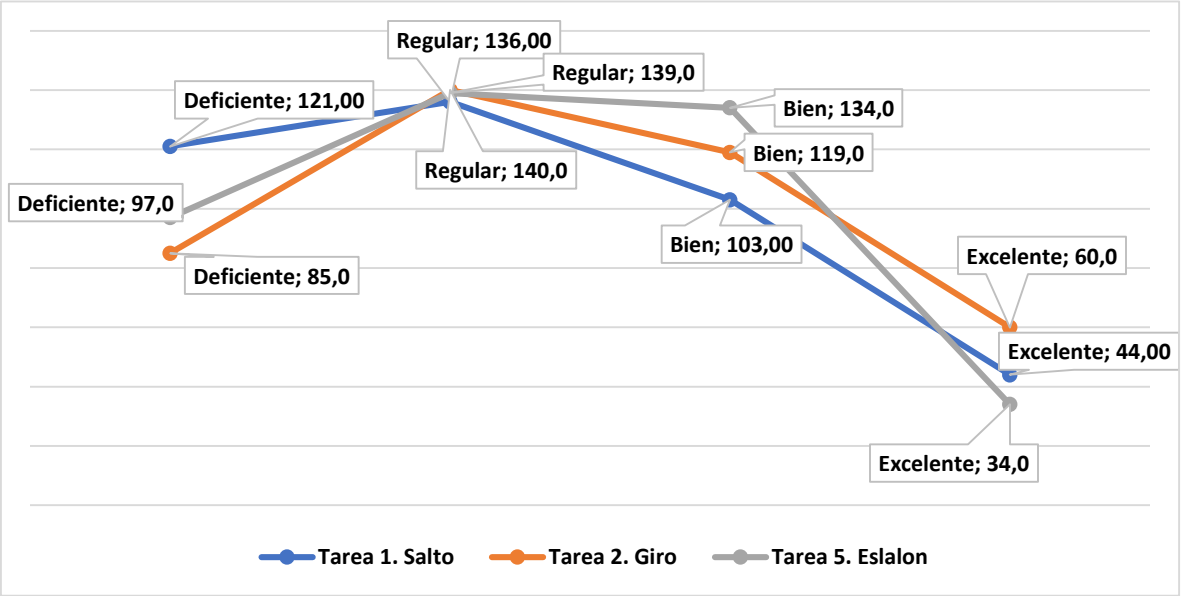

Figure 2. *Evaluative results of tasks that contribute to general dynamic coordination*

In task 2, turning in the longitudinal axis, males outperformed females in all assessments, although the Chi square test ($X^2 = 0.168$; $p>0.983$) did not indicate the existence of significant differences between them, while the Kruskal Wallis statistic indicated significant differences ($K= 1.800$; $p<0.047$), according to the level of education, without grouping according to the post hoc test; in task 5, slalom race, the best results were presented in the regular and good evaluation categories, but not in the excellence category.

The contrast according to sex indicated significant differences ($X^2 = 2.106$; $p<0.041$), in favor of boys. On the other hand, the determination of the contrast by school level indicated significant differences ($K= 4.412$; $p<0.005$), a condition that did not exist and allowed their grouping, through the post hoc test in fourth-fifth and sixth-seventh grade students.

In relation to the tasks that were submitted to the CVM (Figure 3), it presented a situation similar to the CDG, since a high number of students were rated as deficient in each of them, although in all tasks the condition that prevailed was regular.

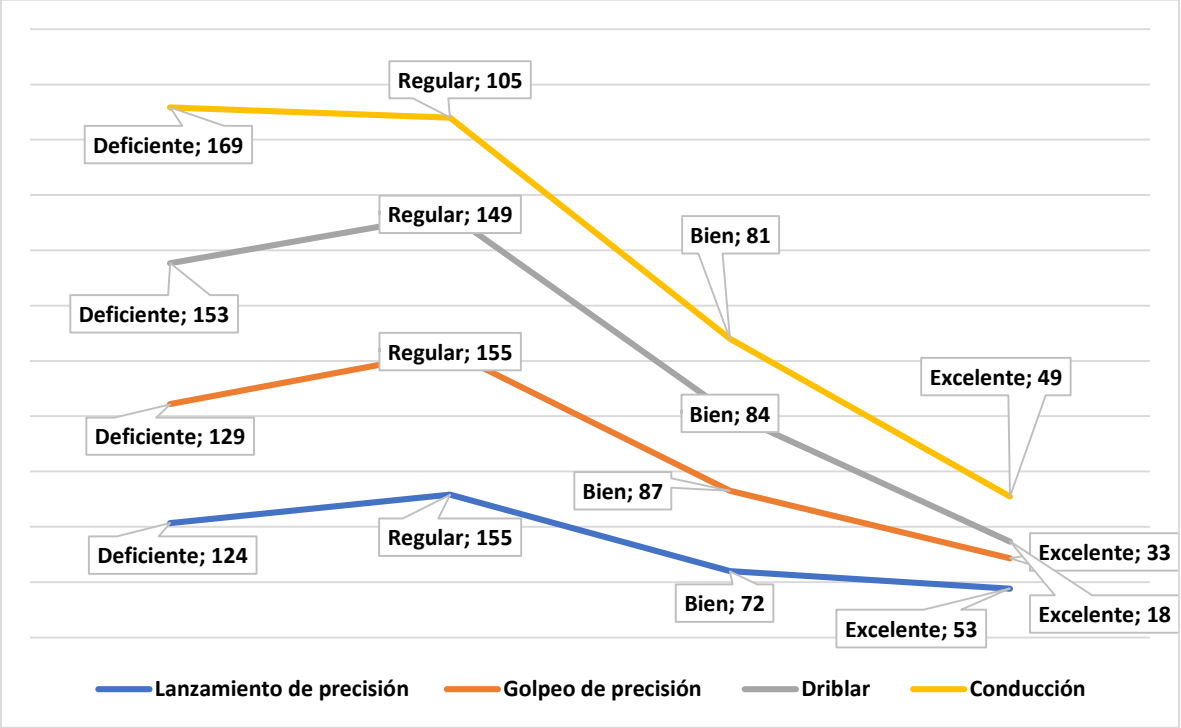

Figure 3. *Evaluation results of tasks that contribute to visual-motor coordination*

The results in each of the tasks were considered , and significant differences were found by sex, according to the Chi square test ($X^2_{Launch} = 0.688$; $p < 0.006$; $X^2_{Hit} = 4,678$; $p<0.046$; $X^2_{Dribble} = 0\ ,411$; $p<0.005$; $X^2_{Driving} = 3.206$; $p<0.037$), while by level of education the Kruskal Wallis statistician expressed differences in all of them (($K_{Throwing} =2.740$; $p<0.043$; $K_{Hitting} = 15,030$; $p<0.000$; $K_{Dribble} = 8.712$; $p<0.000$; $K_{Driving} = 11.640$; $p<0.000$) and the post hoc test defined clusters, such as task 3, precision throwing: fourth, fifth and seventh level; task, precision hitting: fifth and sixth; task, dribbling: sixth and seventh; and task, driving: sixth and seventh.

The evaluative results of the CDG and the CVM had significant differences between them, according to the Chi square test ($X^2 = 244.310$; $p<0.000$), in favor of the CDG with 157 (39.1%) students evaluated between good and excellent, while the CVM presented 107 (26.2%) in the same category, in determining the association between both, the existence of a significant value was established (Rho=0.546; $p<0.000$).

Finally, the general rating (Figure 4), the CMG showed deficiencies in the development of these capacities and the difference between sexes was not statistically significant ($X^2 = 0.893$; $p>0.827$).

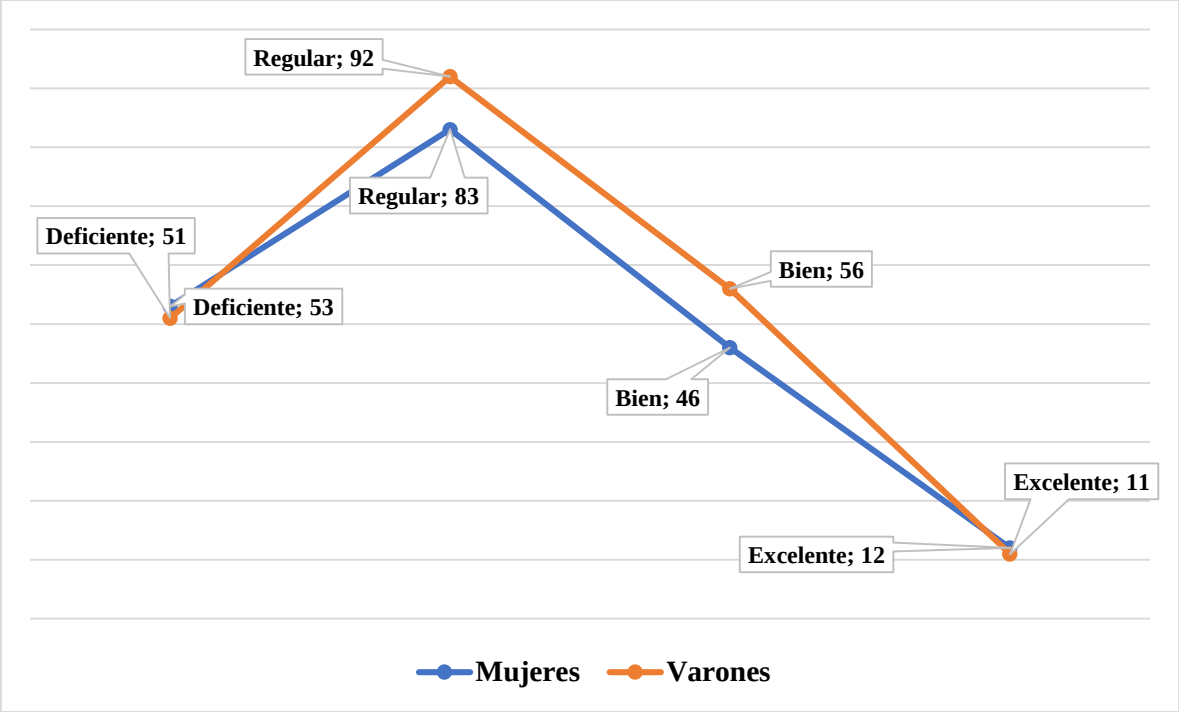

Figure 4. *Overall score obtained by students according to general motor coordination.*

By level of education (Table 4), the fourth level had the highest number of students evaluated as deficient, the fifth level had the highest number of students evaluated as average, followed by the sixth and seventh, in addition to the latter level being the one that surpassed the rest in the evaluations of good and excellent.

Table 4. *Subjects' qualification according to their motor coordination by education level.*

Level of Education	Absolute frequency f(x) and percentage f(%)	Motor condition rating				Total
		Deficient	Regular	Good	Excellent	
Fourth level	f(x)	40	27	16	4	87
	F(%)	38.5	15.4	15.7	17.4	21.5

	% of total	9.9	6.7	4.0	1.0	21.5
Fifth level	f(x)	14	63	33	5	115
	F(%)	13.5	36.0	32.4	21.7	28.5
	% of total	3.5	15.6	8.2	1,2	28.5
Sixth level	f(x)	30	43	18	6	97
	F(%)	28.8	24.6	17.6	26.1	24.0
	% of total	7.4	10.6	4.5	1.5	24.0
Seventh level	f(x)	20	42	35	8	105
	F(%)	19.2	24.0	34.3	34.8	26.0
	% of total	5.0	10.4	8.7	2.0	26.0
Total	f(x)	104	175	102	23	404
	F(%)	100.0	100.0	100.0	100.0	100.0

In determining the association between nutritional status and anthropometric variables, with respect to motor condition assessments, according to Spearman `s correlation coefficient (Table 5), the height/age index was not associated with any of the CMG assessment methods, while weight/age had a negative relationship. On the other hand, the BMI/age reached association values and statistical significance with the three assessment methods used to grade the CMG.

Regarding the anthropometric variables (Table 5), height was positively associated with the CVM and the CMG, while weight was negatively associated with the CVM and the CMG, an association that was also true for age with respect to CVM and CMG.

Table 5. *Correlation between nutritional status classification and anthropometric variables with motor condition assessment criteria.*

Parameters	Correlation coefficient (Rho) and p_value	Assessment of motor coordination		
		General dynamic coordination (CDG)	Visual-motor coordination (CVM)	General Motor Coordination (CMG)
Correlation of nutritional status classification variables				
Size/age	Rho	0.008	0.023	0.014
	P_value	0.872	0.641	0.78

Weight/age	Rho	0.003	0.039	-0.423
	P_value	0.945	0.433	0.006
BMI/Age	Rho	0.447	0.517	0.41
	P_value	0.034	0.007	0.045
Correlation of anthropometric variables				
Size	Rho	0.041	0.53	0.47
	P_value	0.407	0.002	0.016
Weight	Rho	0.004	-0.41	-0.417
	P_value	0.931	0.007	0.004
Age	Rho	0.07	0.662	0.414
	P_value	0.16	0.000	0.005

The values presented demonstrated the insufficiency between the nutritional status and the GMC of the students. To contribute to the solution of this problem, a set of physical activities were proposed, based on improving coordination and nutrition, and a selection of activities from the works of Chuya & Jarrín , 2021; Gámez , et al., 2022; Bennasar , 2023; Román & Díaz, 2020):

Activity 1

- To improve students' nutrition, a reduction in sedentary lifestyles, consumption of sugary drinks and unhealthy snacks was achieved; consumption of fruits and vegetables was increased and the frequency of physical exercise was increased.
- To work on spatial, inter- and intramuscular coordination and eye, hand, foot and head coordination, the following games were played: cat and mouse, performances, transfer of objects, throwing, freezing, tag, relays, traditional macatetas game, juggling, jumping rope, frontal headbutt with balloons, three feet, the elastic, lateral headbutt with balloons, pulling the rope and shooting.
- To evaluate motor coordination, the following were implemented:
- Jump with both feet together over the cones.
- Perform a jump and turn on the longitudinal axis.
- Throw two balls at the post of one of the baskets, from a distance and without leaving the box.

- Hit two balls at the post of one of the baskets from a distance and without leaving the box.
- To move running, zig-zagging.
- Dribbling a basketball back and forth overcoming a simple zigzag and changing direction around a cone.
- Dribbling a ball back and forth with your foot, changing direction by going around a cone.
- At the end of these activities, the teacher applied a coordination test to assess its effect and provide feedback on the process. This test had 4 activities:

Activity 2

- Vertical jump (CDG): From a bipedal and static position, after having previously drawn a line, the student performed continuous jumps with both feet together, in front of a first obstacle (suspended pike). In an identical and immediate manner, two obstacles were placed with pikes similar to the first jump.

Activity 3

- Turn on longitudinal axis (CDG): A cross was drawn on the floor and placed on the perpendicular parallel line. The idea was to make a jump from top to bottom, followed by a turn on the longitudinal axis. The proposed goal was to execute a complete 360º turn. It was taken into account that the closer to the degrees, the higher the turns, and the values recorded were of greater value. The student could choose to make the turns indistinctly, to the left or right, without affecting the evaluation.

Activity 4

- Hand precision shooting (CVM): It is preferable to take a small ball, for example a tennis ball, previously draw a square, to allow mobility, and throw the ball towards a soccer goal post, it was indicated to be located no more than five meters away.

Activity 5

- Precision foot shot (CVM): The objective of this activity was to perform the same task proposed in activity three, with the difference that the feet were used to hit the ball into the goal, and the tennis ball was changed to a soccer ball.

In order to obtain tangible, quantitative, information on the effects of these activities, a survey based on the cognitive, procedural and evaluative dimensions was applied. Once applied, 15 students with coordination difficulties were taken into account and the results of the cognitive dimension showed that 95% of them became familiar with the proposed activities to improve nutrition and coordination, understood the meaning of the games, as well as the characteristics and the measurement of time in which they should practice them.

In the procedural dimension, 85% of the students followed a diet as healthy as possible, in accordance with their purchasing power, and developed physical-motor skills to carry out the activities, such as flexibility, endurance, strength, coordination and also motivation and perseverance, in each of the games.

In the evaluative dimension, 97% of students had a positive opinion on the importance of healthy nutrition and on the implementation of games and activities; according to the prevailing criteria, group unity was fostered inside and outside the classroom, since the proposed games were the ideal context not only to improve coordination based on nutrition, but also for the necessary cohesion between students in the group.

DISCUSSION

According to the results obtained in the applied diagnosis, the average values of the nutritional status indices according to height/age, weight/age and BMI/age were compared with the percentile proposal by Tarupia et al. (2020) for Ecuadorian children and adolescents and it was shown that height and weight were located at p 50, except for 10-year-old females corresponding to the sixth level that were located at p 25; a situation that showed coincidences regarding the height value, but not in relation to the weight condition, with the presented study, since excess weight was underestimated by minimizing its

quantity in the study population, a condition that did not occur with respect to BMI/age between the 50th and 75th percentiles.

The results of the present research regarding the frequency of students, according to the criteria of classification of BMI/age, showed similarities and differences with respect to other studies developed in the Ecuadorian coastal region. The similarities were linked to the limited manifestations of low weight; while the differences were related to the number of subjects with excess weight located in percentage values of around 20% and increasing.

In this sense, the work of Sánchez et al. (2022) carried out on 267 subjects from the city of Milagros (Guayas) declared a minimum of underweight individuals; however, the number of overweight and obese individuals reached values of 28% and 22% respectively, a similar study carried out by Guanoluisa et al. (2022) on 394 children in the Quevedo Canton (Los Ríos) showed 9% overweight and 20% obese; the exception was the result of the research by Yaguachi et al. (2021), in a sample of 515 children and adolescents from the city of Guayaquil (Guayas) who declared 87.2% normal weight and very low values with underweight or overweight.

Regarding the CMG and the proposed activities, it is agreed with the criteria of Cenizo et al. (2017); Herlitz et al. (2021) and Hurtado et al. (2023) since these actions represent a progressive process that favors the nervous system, the osteo-articular system and the sensory system, in the solution of tasks associated with human motor skills, therefore, its development is essential for biological maturation, health and the development of social skills; such propositions, from the results of the present work, represented an alarm point for the students diagnosed due to the deficiencies detected and the little progress linked to the increase in activities that consider the chronological and biological age and the different types of physical coordination that need to be improved.

CDM reflects the tendency to use and control large muscle masses and is associated, in the process of human growth, with gross motor skills, mastery of global movements and fine motor skills or those of the visual-motor, hand-eye or foot-eye coordination type, which make possible the execution of small but precise movements (Escolano, et al., 2020);

therefore, the evaluation of deficient and fair in the study population demonstrated the lack of motor skills in both directions, and the lack of control of the entire body or body segments, as well as the inability to solve motor problems efficiently.

It is highlighted that the evaluation results indicated above were not limited to a fourth level or grade, they extended to an age range and schooling typical of Basic General Education; such condition indicated that although there were inadequacies in the educational processes from the empiricism of the home through play or housework, the educational institution focused on training from the knowledge of science or the arts and limited the influence of the action of Physical Education, to promote the generation of risk factors associated with poor performance from psychomotor skills (Sanz, 2019).

The statistical associations obtained from the nutritional status and the anthropometric variables with the motor condition assessments of the study indicated that both height and weight had a disparate incidence, although the height/age index was not statistically significant, the regular increase in height was of positive connotation and reflected physical growth, from the increase in size of the organism and its parts, which although it was not necessarily, proportionally was reflected in the increase in bone mass and consequently, the potential capacity to support greater body mass.

Hernández et al. (2023) stated that weight gain has a negative effect on motor skills, which is consistent with the results of the present study, a fact also demonstrated by Herlitz et al. (2021) in Chilean schoolchildren; while Hurtado et al. (2023) considered sedentary lifestyle, although it was not demonstrated in the present study.

It was stated that the limitations of the work presented included its specificity of analysis in students from a regular and fiscally supported education center in the Ecuadorian coast, a condition that limited the application of the results to other areas of the country, with a notable ethnic diversity; in addition, its design typology did not allow an assessment of the biological development of the sample, although its strength lay in the approach to a topic that has been scarcely studied in the country.

CONCLUSIONS

In conclusion, and after the analysis presented, it is stated that the population under study presented a general condition of normal height and prevalence of normal weight, although with a significant number of students with excess weight, as well as inadequate development of motor coordination, particularly of the visual-motor type.

In the activities proposed to improve coordination, students reached a high cognitive, procedural and evaluative level on these actions that satisfactorily contributed to the irregularities found in the diagnosis.

Regarding the nutritional status associated with CMG, it was significantly demonstrated that there was an inseparable relationship between these two factors, such that adequate nutrition guaranteed an efficient CMG and as a result of these coordinated activities carried out systematically, it contributed to the efficient functioning of healthy nutrition.

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The author is responsible for writing the work and analyzing the documents.