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Director: Fernando Emilio Valladares Fuente

Email: fernando.valladares@upr.edu.cu

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Translated from the original in Spanish

Original article

Weight loss and adipose (fat) tissue oxidation in fitness

La pérdida de peso y la oxidación del tejido adiposo (grasa) en el fitness

Perda de peso e oxidação do tecido adiposo (gordura) em forma

Darío Paúl Guamán Sanguña[1*] https://orcid.org/0000-0001-6925-5536

[*] Corresponding author: dpguamans@uce.edu.ec

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RESUMEN

Introducción: El fitness está orientado a mejorar la condición física y la salud general, donde el control y la pérdida de peso son orientaciones básicas para perfeccionar el equilibrio corporal, potenciando la resistencia aeróbica. Saber el nivel de conocimientos de los especialistas nacionales delimitará los alcances y limitaciones a desarrollar en un futuro programa de intervención.
Objetivo: Validar el nivel de conocimientos de un grupo de especialistas nacionales sobre la pérdida de peso mediante la oxidación del tejido adiposo (grasa) en fitness.
Materiales y métodos: La investigación es descriptiva-explicativa con reforzamiento correlacional, seleccionado bajo un muestreo intencional no probabilístico a 32 especialistas nacionales del fitness a través de dos criterios de inclusión, para lo cual calificarán ocho indicadores teóricos que servirán de base metodológica para diseñar a futuro, un modelo sostenible de entrenamiento fitness.
Resultados: La individualización, las alternativas complementarias y el método anaeróbico obtuvieron los menores puntajes promedios (1.81 puntos, 2.31 puntos y 2.53 puntos respectivamente) en su nivel de importancia, mientras que la asequibilidad y la sostenibilidad un nivel medio (3.19 puntos; 3.34 puntos) y los indicadores control

sistemático, nivel de importancia y el método aeróbico los de mejor puntaje respectivamente (4.13 puntos, 4.56 puntos y 4.75 puntos). Los indicadores analizados evidencian diferentes niveles de importancia.
Conclusiones: Se recomienda realizar una capacitación a los profesionales nacionales del fitness sobre los reales niveles de importancia que reviste cada indicador, enfatizando en la integración de cada componente de entrenamiento, incluyendo los principios estudiados, el entrenamiento anaeróbico como complemento al proceso de intervención aeróbico y las alternativas complementarias.

Palabras clave: Pérdida de peso; Oxidación del tejido adiposo; Fitness.

ABSTRACT

Introduction: Fitness is aimed at improving physical condition and general health, where weight control and loss are basic guidelines to improve body balance, enhancing aerobic resistance. To be informed about the level of knowledge of the national specialists will delimit the scope and limitations to be developed in a future intervention program.
Objective: To validate the level of knowledge of a group of national specialists on weight loss through the oxidation of adipose tissue (fat) in fitness.
Materials and methods: The research is descriptive-explanatory with correlational reinforcement, selected under an intentional non-probabilistic sampling of 32 national fitness specialists through two inclusion criteria, for which they will qualify eight theoretical indicators that will serve as a methodological basis to design a future, a sustainable model of fitness training.
Results: The individualization, the complementary alternatives and the anaerobic method obtained the lowest average scores (1.81 points, 2.31 points and 2.53 points respectively) in their level of importance, while affordability and sustainability a medium level (3.19 points; 3.34 points) and the indicators systematic control, level of importance and the aerobic method the ones with the best score respectively (4.13 points, 4.56 points and 4.75 points). The indicators analyzed show different levels of importance.
Conclusions: It is recommended to train national fitness professionals on the real levels of importance of each indicator, emphasizing the integration of each training component, including the principles studied, anaerobic training as a complement to the aerobic intervention process and complementary alternatives.

Keywords: Weight loss; Oxidation of adipose tissue; Fitness.

RESUMO

Introdução: O condicionamento físico visa melhorar a condição física e a saúde em geral, onde o controle de peso e a perda de peso são orientações básicas para aperfeiçoar o equilíbrio corporal, melhorando a resistência aeróbica. O conhecimento do nível de conhecimento dos especialistas nacionais delimitará o escopo e as limitações a serem desenvolvidas em um futuro programa de intervenção.
Objetivo: Validar o nível de conhecimento de um grupo de especialistas nacionais em perda de peso através da oxidação do tecido adiposo (gordura) em condição física.
Materiais e métodos: A pesquisa é descritiva-explicativa com reforço correlacional, selecionada sob uma amostragem intencional não-probabilística de 32 especialistas nacionais em fitness através de dois critérios de inclusão, para os quais eles qualificarão

oito indicadores teóricos que servirão como base metodológica para projetar um modelo sustentável de treinamento de fitness no futuro.
Resultados: Individualização, alternativas complementares e o método anaeróbico obtiveram as notas médias mais baixas (1,81 pontos, 2,31 pontos e 2,53 pontos, respectivamente) em seu nível de importância, enquanto que a acessibilidade e sustentabilidade obtiveram um nível médio (3,19 pontos; 3,34 pontos) e os indicadores controle sistemático, nível de importância e o método aeróbico obtiveram as melhores notas, respectivamente (4,13 pontos, 4,56 pontos e 4,75 pontos). Os indicadores analisados evidenciam diferentes níveis de importância.
Conclusões: Recomenda-se a realização de treinamento para profissionais de fitness nacionais sobre os níveis reais de importância de cada indicador, enfatizando a integração de cada componente de treinamento, incluindo os princípios estudados, o treinamento anaeróbico como complemento ao processo de intervenção aeróbica e alternativas complementares.

Palavras-chave: Perda de peso; Oxidação do tecido adiposo; Adequação.

INTRODUCTION

Currently, within the fitness world there are various goals that include weight loss for a better presence of muscle tone and better physical condition (Kennedy, Lavie, & Blair, 2018; Cantieri, de Barros, de Arruda, Gome, & Aranha, 2019), but due to the misinformation that can be found on social networks, unhealthy advice from people with empirical knowledge, miracle diets, supplements and misleading advertising in general, (Pellicer Jordá, 2016) endless activities that are supposed to help lose body weight, but that generate an unknown: Are we losing weight in a healthy way?

Weight loss can be caused by dehydration, excessive food restriction, excessive physical exercise, but in general they would not be associated with good health or well-being. However, one of the alternatives for weight loss is the oxidation of adipose tissue, (Benito, Calvo, Gómez, & Iglesias, 2014) being the fundamental purpose pursued by fitness, (Carrillo, 2011) relating it to a good state of health or physical well-being, given the conversion of fat into energy through the presence of oxygen, when applying long-term aerobic exercises (León, Morales, & Chávez, 2016).

Additionally, within the existing alternatives for body weight control and its reduction, dehydration is found, being the clinical expression of a negative balance of water and solutes in the body, (Medrano Lazo & Pino Castillo, 2019). Alternative that is sometimes used in sports that present weight divisions, while the consumption of calories is also a valid alternative, because as indicated by Urdampilleta, Martínez, & Gómez-Zorita (2012), to lose body weight you must lower the daily calorie intake. Regarding this, Bonilla (2017) states that the management of the decrease in calories and macronutrients must be controlled, which generates a loss of body fat in the subject and reflects a reduction in body weight; in this sense, weight control is an essential component to lose weight, (Amzallag, 2000). For this reason, the pertinent measures must be taken according to the needs of the subject to be trained. The negative part is that an excessive decrease in calories and macronutrients can harm health and well-being (Gilma, 2019).

The sciences of physical activity and sport have the theoretical and methodological foundations necessary to develop sustainable physical intervention projects, where the literature describes specific models for the control and reduction of fat mass and, therefore, body weight. Illustratively, it is proposed that the work carried out by Fernández-García, Gálvez-Fernández, & Gavala-González (2019) reflects the application of incremental aerobic exercise for 12 weeks in three non-consecutive days of 60 to 90 minutes per session. This shows that a decrease in body weight is generated, in which other alternatives arranged in consulted works prevail (Morales, Velasco, Lorenzo, Torres, & Enríquez, 2016; Antón, Morales, & Concepción, 2018; Pardos-Mainer, Gou-Forcada, Sagarra-Romero, Morales, & Concepcion, 2021). For a better understanding, García, Arguello, & Velásquez, (2021) express that body weight is divided into adipose mass, muscle mass, bone mass, residual mass and skin. Fat mass is more closely related to fitness, since in order to generate healthy weight loss, the oxidation of adipose tissue is stimulated, normally prescribing aerobic exercise.

By performing physical exercise, we can generate a change in our body, one of them is weight loss, but what happens when you reach an extreme or excess of exercises? Pallares (2019) describes as a symptomatology of an athlete who has been overtrained the fact that the appetite is decreased (anorexia) and body weight is lost, considered an unhealthy loss, since overtraining is harmful to health (Delgadillo, Alvarez, Barrera, & Soto, 2021).

Espinoza-Salinas, *et al.* (2020) mention that the process to reach the oxidation of fats implies the correct implementation of the principles of the prescription of physical exercise. Here a specific activity is carried out to generate physiological responses that allow adaptation to the delivered stimulus, in this case, to facilitate the energy metabolism of fatty acids. Thus, the mechanisms required for this metabolic process are: mobilizing fatty acids (FA) by the mechanism of lipolysis, transporting the FA via the bloodstream to the muscle tissue and, finally, their oxidation in the muscle mitochondria. Constant physical exercise with variations in training intensities generates physiological responses that allow adaptation to the delivered stimulus, which facilitates the energy metabolism of fatty acids and generates beneficial effects to induce long-term weight loss (Espinoza-Salinas, *et al.,* p. 309).

There is a healthy weight loss, which occurs through adequate exercise and control of necessary calories and an unhealthy weight loss caused by dehydration. It is an excessive restriction of calories and overtraining that affects the homeostasis of the system. To recognize the importance of sustainable oxidation of adipose tissue, one must understand how it occurs in the body and what factors must be taken into account for healthy weight loss to occur. Among other aspects, this is related to the level of knowledge that specialists have in the field, since a bad training plan can cause unwanted effects.

In this sense, a research, as a preliminary step, must carry out a systematic search to recognize the importance of adipose tissue oxidation within a healthy weight loss in fitness as a field of study, although it is also useful to determine the level of knowledge of national specialists on directly and indirectly related topics, diagnosing their knowledge and, therefore, their professional level to face tasks related to the subject of study. However, as there is diverse information on social networks about dietary supplements, miraculous diets, unplanned routines, among others; there is confusion on the part of people who practice fitness, and even specialized sports training

professionals, who ignore the reality that exists in healthy weight loss and the importance of adipose tissue oxidation in it.

For this reason, the purpose of the research is to validate the level of knowledge of a group of national specialists on weight loss through the oxidation of adipose tissue (fat) in fitness, serving as a theoretical and methodological basis to conform to future models. sustainable specialized training.

MATERIALS AND METHODS

The research is descriptive-explanatory with correlational reinforcement, previously studying the criteria of 32 national specialists (Republic of Ecuador) on weight loss through oxidation of adipose tissue (fat) in fitness. A non-probabilistic intentional sampling was applied for the selection of national specialists that included two requirements as inclusion criteria (work experience in fitness for at least ten years, fourth-level degree in Physical Activity and Sports Sciences or related that would include master's degrees and/or specialties).

The analysis indicators are:

1. Level of importance (NI): Refers to the level considered by specialists of the importance of fitness for the reduction and/or control of body weight in humans.
2. Sustainability (S): refers to the possibility of carrying out fitness training for weight loss through the oxidation of adipose tissue that does not cause health problems in the subjects to be intervened (problems such as overtraining, injuries, demotivation, sports anemia, etc.).
3. Individualization (I): refers to the application of the principle of individualization of fitness training to solve problems of overweight and/or obesity with specialized training.
4. Affordability (A): refers to the application of the principle of affordability of fitness training to implement stimuli according to the possibilities of the subjects to train.
5. Systematic control (SC): refers to the importance of systematic control to determine health problems, advances and needs of each trained subject to decrease body weight through oxidation of adipose tissue (fat) in fitness.
6. Aerobic method (AM): refers to the importance of the aerobic method for the reduction of body weight through the oxidation of adipose tissue (fat) in fitness.
7. Anaerobic method (MAn): refers to the importance of the anaerobic method for the reduction of body weight through the oxidation of adipose tissue (fat) in fitness.
8. Complementary alternatives (AC): refers to the importance of other alternatives that complement a classic fitness training for the reduction of body weight through the oxidation of adipose tissue (Nutrition, Supplements, Specialized diet, etc.).

Of the eight indicators analyzed, the specialists will qualify them using a five-level Likert scale, describing below the quantitative and qualitative value of each increasing level:

- Level 1: Very low importance.
- Level 2: Low importance.
- Level 3: Average importance.
- Level 4: High importance.
- Level 5: Very high importance.

Each criterion issued by each specialist will have a score of 1-5 points based on the previous scale, determining the averages for the respective explanatory analysis. Kendall's W test was applied, interpreted as a coefficient of concordance between evaluators, determining the existence or not of agreements between said evaluators, the higher the value of Kendall, the stronger the concordance issued between the specialists consulted in the evaluation of the indicators. arranged in the research. On the other hand, to determine whether there are significant differences between the different scores achieved in each analysis indicator, the non-parametric Kruskal-Wallis H test was applied for k independent samples ($p \leq 0.05$), since there was no normal distribution of the scores. analyzed data.

RESULTS AND DISCUSSION

Table 1 shows the results issued by each specialist consulted in the 8 indicators analyzed, showing the percentages of each indicator in the last row of the table, delimiting theoretically and for the consideration of the specialists the level of importance of each indicator analyzed to be taken into account. for the future design and implementation of an optimal training model proposal, aimed at weight loss through oxidation of adipose tissue from fitness (Table 1).

Table 1. - Results in the analysis indicators

Nope	NEITHER	yes	Yo	A	CS	MA	MAn	AC
1	5	3	1	2	3	5	2	2
2	5	4	2	3	4	5	2	3
3	5	3	2	3	5	5	3	2
4	4	4	2	3	4	5	2	3
5	5	3	2	4	4	4	2	2
6	4	3	2	3	4	5	3	2
7	5	2	2	4	4	4	1	3
8	4	3	3	3	4	5	2	2
9	4	2	2	3	5	5	3	3
10	4	3	2	3	4	5	3	2
11	5	4	2	4	5	5	2	3
12	5	4	1	4	4	4	3	3
13	5	2	2	3	4	5	2	2
14	5	3	2	4	4	5	3	3
15	4	3	1	3	4	5	2	2
16	4	4	2	3	4	5	3	3
17	4	3	2	4	4	4	3	2

18	5	3	2	3	5	5	3	2
19	5	4	1	4	4	5	3	3
20	5	4	1	3	4	5	3	2
21	4	3	2	4	4	4	3	3
22	5	5	2	3	3	5	2	2
23	4	5	2	3	4	5	3	3
24	5	4	3	3	4	5	3	2
25	4	4	2	2	4	4	3	3
26	4	3	1	3	4	5	1	3
27	4	5	2	4	5	5	3	2
28	5	3	2	3	4	4	3	2
29	5	3	1	3	4	5	3	2
30	5	2	1	3	5	5	2	1
31	4	3	2	3	4	5	3	1
32	5	3	2	2	4	4	2	1
□ $\overline{X}$	**4.56**	**3.34**	**1.81**	**3.19**	**4.13**	**4.75**	**2.53**	**2.31**

Of the eight indicators shown in Table 1, the indicator "level of importance" that fitness has for the reduction and/or control of body weight in humans reached the second highest average score of the study (4.56 points), with a level qualitative between "high to very high importance". This is an indication that Ecuadorian fitness professionals are aware of the real potential to reduce body weight through specialized adipose tissue oxidation training. This is how it is defined in the specialized literature as a mechanism of mobilization, transport and oxidation of fatty acids from the physiological point of view of loss of fat and/or body weight, (Espinoza-Salinas, *et al.,* 2020). Hence one of the most important contributions of fitness, as determined by Kennedy, Lavie, & Blair (2018).

However, the "sustainability" indicator presented a mean score of 3.34 points (Average Level of Importance) issued by the specialists consulted, which shows that the specialists are not clear to what extent optimal training can be achieved from the point of view of training fitness view. This does not cause health problems such as those mentioned in the methods section, which are emphasized in subjects with previous joint problems such as spinal deviation (Kriventsova, *et.* 2017). Other problems associated with sports injuries and overtraining are also presented, problems that can be solved by applying, among other aspects, principles of training such as individualization and affordability, indicators analyzed below.

The "individualization" indicator obtains an average score of 1.81 points (importance level between very low and low), this is the indicator that reaches the least score in its level of importance, however, in fitness, said principle, in theory, has priority according to Freese (2019). What focuses on health-oriented leisure sports-physical activity

facilities, where the client must have specialized personnel capable of developing individualized intervention programs, given that considering the individual norm of each trainee includes the design of feasible loads, as concluded by Druz, *et al.* (2017). This is an aspect that also argues the affordability principle analyzed as an indicator in this study. On the other hand, the individualization of the loads implies controlling the subject in an initial diagnosis, which measures and evaluates the physical fitness and general health of the subject to be intervened. In this sense, each individual must undergo specialized aerobic training and fulfill assumptions of inclusion; and when presenting different health problems or advantages, the physical stimuli to which they must be subjected must be different. For which, Burke (1979) has for decades evidenced the need to design individualized physical conditioning programs, even for healthy adults.

On the other hand, as a defense of the criteria issued by specialists on the importance of applying the principle of individualization, it should be noted that time and a large number of specialized personnel are required. Aspect that attends, in the specialist's considerations, in the real application of said principle of training, hence the low rating issued by the specialists consulted. However, in the opinion of the author of this research, it is essential to find strategies that involve the application of the principle of individualization in fitness, since a general training model will not be correctly adapted to the needs of each client. Aspect that can cause non-compliance with the objective of controlling or reducing body weight.

Regarding the "affordability" indicator, previously mentioned authors such as Druz, *et al.* (2017) indicate the need for training models that have feasible stimuli or loads. This is because the requirements for weight control and loss vary considerably depending on each somatotype, the body likes of the trained subject, the age range, pre-existing diseases, among others. However, the average score reached was 3.19 points (Average level of importance), since the specialists consider that it is a factor to consider, but it does not have high relevance. In this sense, the author of the present research is based on the consultation of the primary sources of research. In the comprehensive analysis that every human process must take place, he considers that the principle of affordability is essential to achieve fitness training models, which causes sustainable loss of body weight through the oxidation of adipose tissue, for which it is recommended to perfect the process of improvement of specialized personnel in the use of sports training principles, essential for fitness training, such as the individualization of physical loads and the principle of affordability.

On the other hand, analyzing the indicator "Systematic control", it is essential to appreciate the modifications caused by a certain training, (Morales & González, 2014; Morales & González, 2015) for which it is manifested according to García, *et al.* (2018) in three moments (stage control, habitual and operational). Without systematic control, the application of sustainable training is impossible, nor is the application of principles such as those analyzed in the research in this regard possible. When analyzing the average score issued by the specialists (4.13 points: high level of importance), it is considered that the specialists value, at least from the theoretical point of view, of enormous importance the planning and organization of a fitness training model that have considerable systematic control.

In the case of the importance of the "aerobic method" indicator, the average score achieved was the highest in the research (4.75 points; between High and Very High), a logical aspect given that it is the method of choice in fitness to reduce body weight (Cantieri FP, de Barros, de Arruda, Gome, & Aranha, 2019; Cantieri FP, de Barros, de

Arruda, Gome, & Aranha, 2019). However, the average reached in the "anaerobic method" indicator was qualitatively qualified as being between Low and Average (2.53 points), given that the national specialists consulted do not value the anaerobic method as effective in reducing body weight through oxidation of adipose tissue; even so, examples in the consulted literature show that combining aerobic and anaerobic training in wrestling athletes has significant effects on indicators such as Cholesterol, HDL-C and LDL, (Demirel, Özbay, & Kaya, 2018) and plasmatic leptin, (Elerian, Abdeen, Elmakaky, & Mostafa, 2020), therefore, a combination of aerobic and anaerobic training could improve control and loss of body weight.

In this sense, national specialists undervalue anaerobic training, since the oxidation of adipose tissue is physiologically caused in an eminently aerobic training, (Espinoza-Salinas, *et al.,* 2020) even so there are additional alternatives that complement the optimization to lose body weight, which includes diet, specialized physical activity, and even training at altitude or in intermittent hypoxia, (Urdampilleta, Martínez, & Gómez-Zorita, 2012) including the use of anaerobic training as indicated in the previous paragraph. On the subject analyzed, it is considered useful to design professional improvement actions for national fitness specialists in the future, with a view to designing and implementing comprehensive training models for the control and loss of body weight. Aspect that, theoretically, the national specialists consulted have considered to be of "Low" importance, as can be assessed from Table 1 with the analyzed indicator "Complementary Alternatives" (2.31 points).

On the other hand, the analysis of the results issued in the Kendall W Test (Table 2), determines a high concordance index between experts consulted (0.822), for which there is consensus between the score issued by each national specialist, an aspect that It allows inferring congruent theoretical evaluations of each analyzed indicator, in addition to a high reliability index in terms of ideas, knowledge and professional behaviors. Therefore, the possibility of generalizing future intervention actions based on the theoretical criteria issued by the specialists consulted in this research is considered.

Table 2.- Kendall's W test

Ranks	
	average range
Importance level	6.92
Sustainability	4.56
Individualization	1.63
affordability	4.25
Systematic Control	6.19
Aerobic method	7.22
Anaerobic Method	2.89
Complementary Alternatives	2.34

Test statistics

N	32
W for Kendall [to]	,822
Chi squared	184,224
gl	7
asymptotic sig.	,000

a. Kendall's concordance coefficient

On the other hand, the comparison of the average ranges obtained with the Kruskal-Wallis H (Table 3) shows significant differences (p=0.000) in the scores achieved by each analysis indicator. Hence, differences arise in the levels of importance for the consideration of national specialists. This aspect determines the need to carry out professional improvement work with national specialists through seminars, specialized talks, courses, clinics, among others, with a view to increasing the level of knowledge about each analysis indicator. What is emphasized is the comprehensiveness that a sustainable training model needs to reduce body weight by enhancing the oxidation of adipose tissue.

Table 3.- Kruskal-Wallis H test

ranks			
	Groups	N	Average range
Data	NI	32	205.84
	S	32	128.39
	I	32	36.88
	A	32	118.63
	CS	32	180.03
	MA	32	216.63
	MAn	32	77.34
	AC	32	64.27
	Total	256	

Test statistics [a,b]	
	Data
Kruskal–Wallis H	195,695
gl	7
asymptotic sig.	,000
a. Kruskal-Wallis test	
b. Grouping Variable: Groups	

CONCLUSIONS

The indicators analyzed show different levels of importance given by each national specialist consulted, levels to be taken into account for weight loss through oxidation of adipose tissue in a fitness training model. Being the present research a theoretical and methodological validation to prospectively conform a sustainable model of specialized training. It is recommended as a preliminary step to train national fitness professionals on the real levels of importance of each indicator, emphasizing the integration of each training component, including the principles studied, anaerobic training as a complement to the aerobic intervention process and the complementary alternatives indicated.

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The authors declare that there is no conflict of interest.

Authors' contributions::
Darío Paúl Guamán Sanguña: Conception of the idea, literature search and review, instrument making, instrument application, compilation of information resulting from the instruments applied, statistic analysis, preparation of tables, graphs, and images, database preparation, general advice on the topic addressed, drafting of the original (first version), review and final version of the article, article correction, authorship coordinator, translation of terms or information obtained, review of the application of the applied bibliographic standard.