74 - ANALYSIS OF THE INFLUENCE OF THE EXTERNAL NASAL DILATOR ON THE AREA OF THE NASAL CAVITY IN REST AND ON THE MAXIMUM CAPACITY IN THE ACTIVITIES THAT USE THE OXYGEN FROM THE AIR AND THE HEART RATE IN CYCLE ERGOMETER

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INTRODUCTION

In 1996, during the European Cup and the Games Olympics Of Atlanta, some competitors used the external nasal dilator (DNE) believing that they would have benefit in their results (MOL and GIANNICHI, 1998). According to these authors, this device could develop the physical capacity of athlete during predominantly activities that use the oxygen from the air, due to the anatomical and mechanical factors of it.

In high levels of ventilation, the sanguineous flow and the consumption of oxygen of the respiratory muscles are substantial, being able to limit the maximum exercise for the direct competition among the active muscles of the exercise and the respiratory ones (HOPKINS and McKENZIE, 1993). That way, athletes, trainers and manufacturers believe that the DNE allows an increase in the maximum capacity in the activities that use the oxygen from the air - $V0_{2max}$ (MOL and GIANNICHI, 1998) because this device increases the area of the nasal cavity (GRIFFIN, HUNTER, FERGUSON and SILLERS, 1997). This increment in the $V02_{max}$ is due to the lesser energy spent for the respiratory muscles due to reduction of the resistance of the nasal cavity the aerial flow (GRIFFIN, HUNTER, FERGUSON and SILLERS, 1997), remaining more available energy for the involved active muscles directly in the exercise (O'KROY, JAMES, MILLER, TOROK and CAMPBELL, 2001).

To measure the resistance of the nasal cavity in the aerial flow a technique of acoustic rhinometry is used that, according to Portugal, Mehta, Smith, Sabnani and Matava (1997), are measurements of reflections of sonorous waves proceeding from the nasal cavity amplified and digitalized by a microphone located in the DNE of the device. According to Cole (2000), the acoustic rhinometry is a fast, not invasive, reproducible, necessary method and of accessible cost for evaluation of the resistance of the nasal cavity.

Some studies used the acoustic rhinometry technique to measure the area of the nasal cavity with DNE use and placebo of DNE (PDNE) and found an increase in the same one using the first device (GRIFFIN, HUNTER, FERGUSON and SILLERS, 1997; NIINIMAA, GLUE and MINTZ, 1981; PORTUGAL, MEHTA, SMITH, SABNANI and KILLED, 1997). Amongst the studies relating the ventilation and the VO_{2max}, some analyzed the influence of the DNE in the income of the individuals. An agreement in the results of these studies was found that allege that the device does not influence the $V0_{2max}$ and the heart rate (HR) (MOL and GIANNICHI, 1998; CHINEVERE, WOULD MAKE and MAKE, 1999; O'KROY, 200; O'KROY, JAMES, MILLER, TOROK and CAMPBELL, 2001).

The objective of this study was quantitatively to determine through the acoustic rhinometry if there is some increase in the area of the nasal cavity in rest with the use of the DNE and the PDNE developed for the researchers and to analyze the influence of the DNE on the $V0_{2max}$ and the HR of physically active individuals.

Methods

The present study was divided in two phases:

1) First: construction and test of the placebo of external nasal dilator (PDNE1 and PDNE2) and analysis of the nasal cavity in rest through acoustic rhinometry.

2) Second: evaluation of the maximum capacity in the activities that use oxygen from the air and the cardiac frequency during the application of the PDNE1 and DNE (CLEAR PASSAGE) comparin with controlled group (GC).

Eight individuals, healthful, with age between 20 and 32 years, were used as voluntaries of the masculine sort. The exclusion criteria was: history of nasal trauma or nasal surgery previous, allergic rhinitis, nasal polyp, asthma or bronchitis, infection of superior aerial duct recent or recurrent, not medicine use. The tests constituted of four experimental situations, being these GC, PDNE1, PDNE2 and DNE.

The collection of data was made in a clinic medical, with the acoustic rhinometry device (Eccovision Acoustic Rhinometer - Model AIR 1003, Hood Laboratories, Pembroke, Me, the USA), the norms of standardization of the Acoustic Rhinometry (HILBERG and PEDERSEN, 2000; PARVEZ et al, 2000). The tests were executed in two days (one in each week), being that in each day the experimental situations with n=4 were made all. An appraiser was assigned for the installation of the device and two ones for application of the test.

The data were treated through the statistical test considered by Montgomery (1996), of analysis of variance, called drawing of the Latin square with repeated measures, of blockages with two rejoinders of a square 4x4, being four devices applied in four distinct times (every five minutes), after that one post hock was made for identification of the differences, for one $p<0,05$.

For the second phase a sample with 12 individuals above of 20 years was used, of the masculine sort, all healthy on the basis of anamnesis, with no affirmative reply to the PAR-Q (ACSM, 2000), and classified as active trained (>40 VO_{2max} $mL0_2.Kg^{-1}.min^{-1}$) according to Yazbek and Batttistella (1994).

The volunteers were invited for a meeting, during which the methodological objectives and procedures were explained by the researcher. At that same moment, they were informed of the possible risks and benefits related to the experiments and signed a term of free and clarified assent.

On the first day of test, the corporal composition was measured through the method of cutaneous folds with the use of a skinfold thickness Body Caliper (JACKSON and POLLOCK, 1993; POLLOCK and WILMORE, 1993). All the individuals filled a form contDNE the nutritional data and the general physical state before each experimental day.

A not elastic metric ribbon of precision in millimeters was used (INMETRO) to collect the corporal circumferences of all the volunteers (shoulder, thorax, waist, abdomen, hip, arm, forearm, thigh and leg).

At the previous moment to the effort test the volunteer was requested to urinate before measuring the corporal mass and the stature (FILIZOLA - 100g). Soon after that the volunteers would have to ingest, obligatorily, 200 ml of water using disposable cups (ZANATTA).

For the measurement of the heart rate (HR), a heart rate monitor was used (POLAR S610 model). The volunteers would have to remain lying during 5 minutes to collect the pressure arterial (PA) systolic and diastolic using a apparatus for adults medium size and a stethoscope (B-D).

The ambient temperature (ºC) and the relative humidity of air (RHA) were monitored through a wet and dry bulb (INCO TERM).

The effort test was according to methodology proposed by Balke (MARINS and GINANNICHI, 1998), in which the volunteers were submitted to periods of two minutes and the weight was progressing of 0,5 in 0,5 kg, in cycle ergometer (MAXX Monark standard). The initial weight was standardized in 2,0 kg for all the volunteers. The HR was written down every minute and registered for the heart rate monitor every 5 seconds.

The used equation to calculate the VO_{2max}, proposal for Marins and Ginannichi (1998) was:

$V0_{2max}$ = 200 + (12 * Watts) / corporal weight

The tests were done in three days consecutive of balanced form being that, in each day, the three experimental conditions occurred, always in the same schedule of the day, being that the recovery interval was of 24 hours among them. The evaluated ones were requested to avoid exercising among the accomplishment of the tests through a form of recommDNEations for the tests.

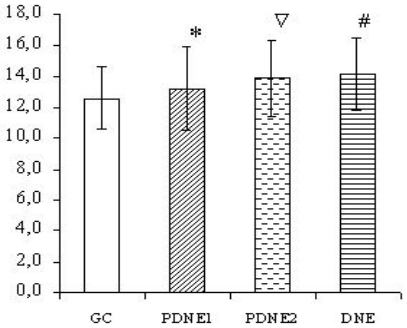
It was used as criterion of interruption of the test when the individual reached an exhaustion state which incapacitated him to continue exercising, the standardized speed of 21, 6 Km/h was not kept or the evaluated one requested the interruption of it (MARINS and GINANNICHI, 1998). At this moment the load was removed in order to remain 2 kg to initiate a period of active recovery of two minutes of duration.

To the DNE of the active recovery, the volunteers were directed to the stretcher where they remained lying during five minutes and they filled, the days of use of the devices (DNE and PDNE), a questionnaire on their perception of which device they believed that it would be using.

The collected data during the test of maximum effort, the ambient temperature and the RHA were analyzed statistically through the Drawing of the Latin Square (MONTGOMERY, 1996). To verify the perception of the volunteers on the use of the DNE and the PDNE, the Test of Chi-square (TRIOLA, 1999; THOMAS and NELSON, 2002) was done. The level of significance for the statistical tests was of p<0,05.

RESULTS

The analyzed data in the first phase of the study presented averages of the nasal volume for the GC=12,6 ± 2,0, PDNE1=13,2 ± 2,7 PDNE2=13,8 ± 2,5 and DNE=14,2 ± 2,3, as presented in graph 1. Differences among the averages of the cubical volumes were observed among the GC-PDNE2, the GC-DNE and the PDNE1-DNE (p<0,05).



Averages of the cubical volumes (cm^3)

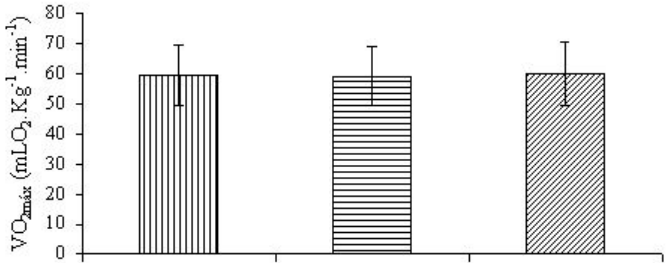
- significant Difference between the DNE and the GC.
∇ - Significant Difference between the PDNE2 and the GC.
* - Significant difference between the PDNE1 and DNE.
P≤0,05.

The following table presents the average values and shunting lines standards of the general corporal characteristics (age, corporal mass, stature, % of fat) of the volunteers of the second phase of the study.

TABLE 01
General corporal characteristics of the volunteers (n=12)

	Age (years)	Corporal mass (Kg)	Stature (cm)	% of corporal fat
Average total	27.1	71.8	175	10.1
Shunting line standard	4.7	4.9	0.06	2.9

The graph 2 shows the VO_{2max} ($mL0_2.Kg^{-1}.min^{-1}$) gotten in the three studied situations. According to the average of the values gotten for the volunteers. Significant differences for the analyzed situations were not found.



In table 02 an analysis was made relative of the HR, comparing the gotten values 35, 55, 75 and 100% of the HR. Graph 03 shows the HR (bpm) represented by three gradual curves that presented the same characteristics to long of the time of exercise for all the analyzed situations. Significant differences were not found as the averages of the joined results show.

TABLE 02
Médias da FC nas situações analisadas.

	HR (bpm)			
	35%	55%	75%	100%
Total Average	109,72	129,61	152,33	178,47
F_0	0,15	0,22	0,26	1,16

Graph 04 presents the frequency of the answers of the volunteers on the perception of the use of the PDNE1 and the DNE. The volunteers perceived the difference between the PDNE1 and the DNE (when they used the DNE: 67% of the volunteers answered that they were using the DNE, 8% the PDNE1 and 25% did not know; when they used the PDNE1: 0% answered that it was using the DNE, 67% the PDNE1 and 33% did not know; p<0,05).

Graphs 05 and 06 show the ambient temperature and the relative humidity of air, respectively, in which the tests were done. Differences in the days and the situations of tests were not found.

DISCUSSION

According to Portugal, Mehta, Smith, Sabnani and Matava (1997), the DNE increased the nasal patency in 21% due to

mechanical factors on the superior nasal cartilage. Griffin, Hunter, Fergusson and Sillers, (1997) found an increase of the rest nasal valve in all the individuals with the use of the DNE, once the studies above confirm the present study. All the measures of nasal patency were taken on the same day. That way, the factors that would modify the nasal resistance in rest and would influence in the results of this study, as the ambient temperature, medicines (in case that use existed) hyperventilation, hormonal factors, alcohol ingestion, physical exercise and inflammation of the nasal mucosa (Bussiéres, Perussel and Leclerc, 2000) would interfere with all the experimental situations of the same volunteer.

The PDNE did not have the purpose to analyze the sensation, however quantitatively to analyze the variation of the related nasal patency to the GC and the DNE. After the accomplishment of the tests of the PDNE1, this device was applied in the second phase of the study together with the DNE and the GC.

According to Griffin, Hunter, Ferguson and Sillers, (1997), with the use of the PDNE there was an increase of the VO2 submáximo and HR, and a reduction of both with the use of the DNE, what it does not agree with the other searched studies. In the article of Chinevere, Faria and Faria (1999), the VO2máx was equal in the diverse situations of ventilation, also with the use of the DNE. O'kroy (2000) and O'Kroy, James, Miller, Toro and Campbell (2001) found resulted equal for VO2máx, as well for HR, in maximum exercises and submáximos, even existing an increase of the area of the nasal cavity and a reduction of the nasal aerial resistance. According to Mol and Giannichi (1998), the extra air inspired would not be absorbed by the organism, consequently, would not improve the performance in the activities that use oxygen from the air, thus, differences were not found among the measured situations.

Although there are different methodologies, there is an agreement between the searched studies and the present study for the results of the VO2máx and the HR. The great difference of this study was the accomplishment of the acoustic rhinometry testing quantitatively the PDNE and the application of a questionnaire of verification of the device. According to answers to this questionnaire, it was perceived that the volunteers knew when they were using the DNE and the PDNE. This perception could generate a motivational influence in the individuals, since the DNE would be a responsible device for the improvements in the sportive performance of athlete in national and international championships. But, despite this possible psychological interference the results the situations were similar in all, that is, both physiologically and emotionally, this implement was not efficient to improve the parameters analyzed in the present experimental group.

CONCLUSION

In the first phase, the DNE increased the area of the nasal cavity in rest and the PDNE1 was quantitatively different of the DNE and equal to the GC, which allows its use as placebo in the second phase of the study. During the accomplishment of the exercise protocol, the DNE did not influence the VO2máx and the HR, despite the volunteers having perceived when they used DNE and PDNE1.

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ANALYSIS OF THE INFLUENCE OF THE EXTERNAL NASAL DILATOR ON THE AREA OF THE NASAL CAVITY IN REST AND ON THE MAXIMUM CAPACITY IN THE ACTIVITIES THAT USE THE OXYGEN FROM THE AIR AND THE HEART RATE IN CYCLE ERGOMETER

SUMMARY

Introduction: Athletes and trainers believe that the external nasal dilator (DNE) is capable to develop the physical capacity during predominantly activities that use oxygen from the air. This is justified due to the anatomical factors and mechanical itself, once, this device can generate an increase in the area of the nasal cavity. Objectives: First phase: To verify quantitatively if there is some alteration in the nasal cavity with the use of the DNE and to construct a placebo of DNE (ENDP). Second phase: to analyze if the DNE exerts influence on the maximum capacity in the activities that use oxygen from the air (VO_{2max}) and the heart rate (HR). Methodology: First phase: 8 individuals, healthful, of the masculine sort with age between 20 and 32 years that had passed for four experimental situations: Control Group (GC), with DNE and two different PDNE (PDNE1 and PDNE2), analyzed through acoustic rhinometry. Second phase: 12 volunteers did a maximum, gradual exercise in cycle ergometer in three situations: use of the DNE, the PDNE and the GC. They answered a questionnaire, analyzed for the Qui-square test ($p<0,05$), informing which the device that they were using. All the other variants were analyzed through the Drawing of the Latin Square ($p<0,05$). Results: In the first phase some difference was observed between: GC and DNE, GC and PDNE2, DNE and PDNE1 ($p<0,05$).. In the second phase any difference ($p<0,05$) for the analyzed parameters was not observed, except for the answers to the questionnaires. Conclusion: The DNE increased the area of the nasal cavity in rest and it did not influence the VO_{2max} and the HR, even existing knowledge, on the part of the volunteers, about the use of it.

KEY WORDS: nasal cavity; maximum capacity in the activities that use oxygen from the air; heart rate.

ANALYSE DE L´INFLUENCE DE DILATEUR NASAL D´EXTERNAL SUR LA REGION DE LA CAVITE NASALE DANS LE REPOS ET SUR LA CAPACITE MAXIMUM DANS LES ACTIVITES QUI EMPLOIENT L`OXYGENE DE LAIR ET LA FREQUENCE CARDIAQUE DANS BICICLE

SOMMAIRE

Introduction : Les athlètes et les entraîneurs croient que le dilateur nasal externe (DNE) est capable pour développer la capacité physique pendant principalement les activités qui emploient l'oxygène de l'air. C'est dû justifié aux facteurs anatomiques et mécanique lui-même, une fois que, ce dispositif peut produire d'une augmentation du secteur de la cavité nasale. Objectifs : Première phase : Pour vérifier quantitativement s'il y a un certain changement de la cavité nasale avec l'utilisation de DNE et pour construire un placebo avec de DNE (DNEP). Deuxième phase : pour analyser si DNE exerce l'influence sur la capacité maximum dans les activités qui emploient l'oxygène de l'air (VO2max) et de la fréquence cardiaque (FC). Méthodologie : Première phase : 8 individus, salubres, de la sorte masculine avec l'âge entre 20 et 32 ans qui avaient passé pour quatre situations expérimentales : Groupe de commande (CG.), avec DNE et deux différent DNEPs (DNEP et DNEP 2), analysés par le rhinometer acoustique. Deuxième phase : 12 volontaires ont fait un exercice maximum et progressif dans le mecanicien bicicle dans trois situations : utilisation de DNE, de DNEP et du GC.. Ils ont répondu à un questionnaire, analysé pour l'essai de Qui-carré ($p<0,05$), informant quel le dispositif qu'elles utilisaient. Toutes les autres variantes ont été analysées par le Dessin de la Carré Latine ($p<0,05$). Résultats: Dans la première phase on a observé une certaine difference entre : GC. et DNE, GC. et DNEP 2, DNE et DNEP 1 ($p<0,05$). Dans la deuxième phase on n'a observé difference ($p<0,05$) pour les paramètres analysés, excepté les réponses aux questionnaires. Conclusion : DNE a augmenté le secteur de la cavité nasale repos et elle n'a pas influencé le VO2max et la FC, même la connaissance existante, de la part des volontaires, quant a l'utilisation de lui.

Mots clés: cavité nasale ; capacité maximum dans les activités qui emploient l'oxygène de l'air ; fréquence cardiaque.

ANÁLISIS DE LA INFLUENCIA DEL DILATADOR NASAL EXTERNO SOBRE EL ÁREA DE LA CAVIDAD NASAL EN REPOSO Y SOBRE LA CAPACIDAD AEROBIA MÁXIMA Y LA FRECUENCIA CARDÍACA EN CICLOERGÓMETRO

RESUMEN

Introducción: Atletas y entrenadores creen que el dilatador nasal externo (DNE) es capaz de incrementar la capacidad física durante actividades predominantemente aerobias. Ello se justifica debido a los factores anatómicos y mecánicos del mismo, ya que, ese dispositivo puede generar un aumento en el área de la cavidad nasal. Objetivos: Primera fase: verificar cuantitativamente se hay alteraciones en la cavidad nasal con el uso del DNE y construir un placebo de DNE (PDNE). Segunda fase: analizar si el DNE ejerce influencia sobre la capacidad aerobia máxima (VO2máx) y la frecuencia cardíaca (FC). Metodología: Primera fase: 8 individuos, saludables, del género masculino con edad entre 20 y 32 años que pasaron por cuatro situaciones experimentales: grupo control (GC), con DNE y con dos diferentes PDNEs (PDNE1 e PDNE2), analizadas a través de rinometria acústica. Segunda fase: 12 voluntarios realizaron un ejercicio máximo progresivo en cicloergómetro en tres situaciones: utilización del DNE, del PDNE y del GC. Respondieron a un cuestionario, analizado por el test de Qui-Cuadrado ($p0,05$), informando qué dispositivo estaban utilizando. Todas las demás variables fueron analizadas a través del Diseño del Cuadrado Latino ($p0,05$). Resultados: En la primera fase se observó diferencia entre: GC y DNE, GC y PDNE2, DNE y PDNE1 ($p0,05$). En la segunda fase no se observó diferencia ($p0,05$) para los parámetros analizados, excepto para las respuestas a los cuestionarios. Conclusión: el DNE aumentó el área de la cavidad nasal basal y no influenció el VO2máx y la FC, aunque había un conocimiento, por parte de los voluntarios, respecto a la utilización del mismo.

UNITERMOS: cavidad nasal; capacidad aerobia máxima; frecuencia cardíaca.

ANÁLISE DA INFLUÊNCIA DO DILATADOR NASAL EXTERNO SOBRE A ÁREA DA CAVIDADE NASAL EM REPOUSO E SOBRE A CAPACIDADE AERÓBIA MÁXIMA E A FREQUÊNCIA CARDÍACA EM CICLOERGÔMETRO

RESUMO

Introdução: Atletas e treinadores acreditam que o dilatador nasal externo (DNE) é capaz de incrementar a capacidade física durante atividades predominantemente aeróbias. Isso se justifica devido aos fatores anatômicos e mecânicos do mesmo, uma vez que, esse dispositivo pode gerar um aumento na área da cavidade nasal. Objetivos: Primeira fase: verificar quantitativamente se há alteração na cavidade nasal com o uso do DNE e construir um placebo de DNE (PDNE). Segunda fase: analisar se o DNE exerce influência sobre a capacidade aeróbia máxima ($VO_{2máx}$) e a freqüência cardíaca (FC). Metodologia: Primeira fase: 8 indivíduos, saudáveis, do gênero masculino com idade entre 20 e 32 anos que passaram por quatro situações experimentais: grupo controle (GC), com DNE e com dois diferentes PDNEs (PDNE1 e PDNE2), analisadas através de rinometria acústica. Segunda fase: 12 voluntários realizaram um exercício máximo progressivo em cicloergômetro em três situações: utilização do DNE, do PDNE e do GC. Responderam um questionário, analisado pelo teste de Qui-Quadrado ($p0,05$), informando qual o dispositivo que estavam utilizando. Todas as demais variáveis foram analisadas através do Desenho do Quadrado Latino ($p0,05$). Resultados: Na primeira fase observou-se diferença entre: GC e DNE, GC e PDNE2, DNE e PDNE1 ($p0,05$). Na segunda fase não se observou diferença ($p0,05$) para os parâmetros analisados, exceto para as respostas aos questionários. Conclusão: O DNE aumentou a área da cavidade nasal basal e não influenciou o $VO_{2máx}$ e a FC, mesmo havendo um conhecimento, por parte dos voluntários, quanto à utilização do mesmo.

UNITERMOS: cavidade nasal; capacidade aeróbia máxima; freqüência cardíaca.