102 - GLYCAEMIC BEHAVIOUR WITHIN RESISTANCE EXERCISES IN DIFFERENT MOMENTS AFTER INFESTING CARBOHYDRATES

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Introduction

A very important characteristic regarding resistance exercises is the great participation of the *glycolitics* activity, with a huge use of muscle glycogen as a source of energy (Roberts e Robergs, 2002). Considering that physical activity improves *sarcoplasmatic* concentration and AMPc, and also that this improvement contributes to the proteic activity GLUT (Champe e Harvey, 2000; Guyton, 1998), that facilitates the acquirement of glycosis by the muscle tissue, which leads to the plausible questioning about the glycosis' blood kinetic during such activities.

Besides, the ingestion of too many carbohydrates before, immediately before ou during the resistance exercise may affect effectivelly the glycemic kinetic (Hargreaves, 2000; Walker et al, 2000; Arkinstall, 2001; Silva et al 2004). Thus, the break between meals and trainment, as well as the type of carbohydrate taken, are factors that may be connected directly to the ability of performing the exercises. It can also be associated to how the metabolism will be regulated in order to satisfy the activity demand and the recovery.

It is known that many hormones that influence directly the metabolism during the exercise are controlled by glycemia. The fatty acid or glycogen use rate during the activity, for instance, is controlled by hormones such as catecholamine, *glucagon*, GH and cortisol (Roberts e Robergs, 2002). This very hormones influence directly the recovery and the muscle anabolism after the exercise, according to recent information of the muscular hypertrophy mechanism (Zhang, et al, 1999; . Hadad, 2002; Gordeon et al, 2001; Eliakin, et al).

A possible catabolism during the exercise may also be the result of hormonal activity, rated by the glycaemia, once the cortisol release is freed it also influences the lipolitic, at the same time it instigates the proteolysis (Wilmore e Costil, 1999; Roberts e Robergs, 2002) in a way that a glycaemic inappropriate behaviour may be causing damage to subjects that take exercises aiming at hypertrophy.

Although the glycaemia has an impotant participation during the exercise and that its help influences the carbohydrates ingestion, research that monitores the glycaemia during the resistance exercise are still insufficient, not only in isolation as well as before the ingestion or support of carbohydrates.

This research brings forth initial elements to the study and discussion of such matter by the scientific community and physical acitivity professionals. It aims at investigating the glycaemic behaviour within the routine of gym clubs.1:In the exercise taken after several hours without any meals (subjects that have lunch at noon and train at night without having a snack or dinner); 2:When these very subjects train under the same circumstances but with a snack full of carbohydrates 30 minutes before; 3: When these very subjects do not take any snacks but support themselves with carbohydrates during the exercise. Data from this research will cooperate with professionals involved with physical activity and will lead to a better understanding of the accute *metabolic* answers to the exercise and the importance of nutrition related to exercises.

METHODOLOGY

This is a descriptive study, pre-experimental, transversal type. The sample was constitude by four (4) male subjects who practice body-building in an advanced level, the age group is between 18 and 25 years old (the average is 20,5), the average height is of 1,80 m, the weight is of 80,1 kg and the *IMC* is of 25,4 Kg/m^2.They took trainning practises seeking to attain hypertrophy, always at night, around 7 p.m., and were used to not taking any snacks in the afternoon or having dinner before the trainment.

In order to select the sample, a permission was required from the owner of the gym club and it was required subjects who would fit the studied proposition. From the volunteers who came forth, the four chosen had detailed explanation about the procedures and were asked to sign in a term which assures their approval, according to the resolution 196/96.

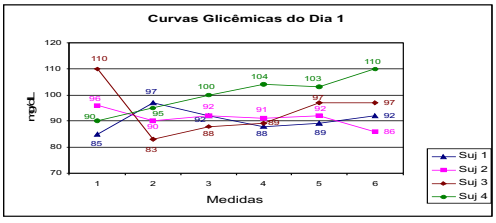
They had their glycaemia monitored through arterial blood samples, taken from their finger in three different situations: Day1, the subjects were asked to take a conventional lunch, based on beans, rice, meat, vegetables and fruit salad between 12 a.m. and 1 p.m. This was the only meal they would have up to the trainment moment, that was to start at 7 p.m. Day 2, subjects were asked to have the same lunch from Day 1, not to take any snacks in the afternoon and arrive at the gym club at the most 6.20 p.m. They had a snack at 6.30 p.m. which was a sandwich and fruit juice sweetened with sugar. After that, they waited for 30 minutes and started the trainment. On Day 3, the subjects took the same lunch, did not take any meals between lunch and trainment, but had the support of *maltodextrine* dissolved into water at 6% six times during trainment, with an amount of 150ml of water at every intake.

A week before the sample procedure, the researchers did an adjustment of the trainment weight to be lifted between 10 and 12 repetitions. The three days trainment was carried out with 3 series of 10 exercises for the inferior parts of the body and 10 to 12 maximum repetitions and a break of 1,5 minute between the series. A standard streching was carried out 10 minutes before on a *treadmill* allowing maximum of 60% of the maximal reserve heart rate in the three procedures.

Regarding the three procedures, the blood samples were taken six times. One immediately after the streching and the others immediately after the third series of the 2nd, the 4th, the 6th, the 8th and the 10th exercises. To take the sample, the asepsis was carried out on the finger, with some cotton totally dampened into alcohol and right after a dry cotton was used to clean the excess. A *glicosimetre* ACCU-CHEK ADVANTAGE from Roche Diagnostics was used as an equipment, witht mininum precision to read the *glycosis* from the test strip of 1mg/dL of blood and the maximum value readable from the equipment is 600 mg/dL. The blood drop was obtained from a lancet and disposable needles.

RESULTS AND DISCUSSION

On Day 1 situation, the average of resting glycaemia plus the averages of the five rates during the exercises were of: 108.8; 95.6; 104.3; 101.8; 103.5 e 104.3. Graphic 1 presents the glycaemic behaviour in each of the 4 subjects. Although they are taking the exercise after 6 or 7 hours of fasting, there was no moment in which the glycaemia had fallen to hypoglycaemic values or even reached values next to 70 mg/dL, which is the boarding limit to the lauching of a hormonal counter-regulating activity. This counter-regulating activity would involve a metabolism control through the improvement of secretion of hormones *glucagon,* catecholamine, GH and cortisol (Gregui, 1999).



Graphic 1: glycaemic behaviour in resistance exercise within fasting situation

This results into a minor obtention of the *glycosis* by the muscle, activation of the *lipasis* enzime, sensible horomone that facilitates the *lipolisis*, with the resulting fatty acid that goes the the muscle tissue and the *glycerol* that is taken by the kidneys and liver. To this extent, the metabolic alteration will diverge the physical activity to the aerobic vias (less use of glycogen and inxcrease in the use of fatty acid) and the glycaemia will decrease, even though it may go through little increments during the exercises.

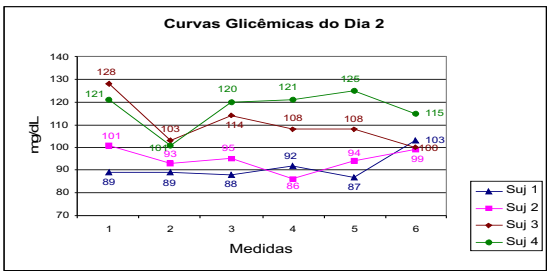
Although the increased use of fat, the secreted cortisol also promotes proteolysis with the purpose of converting some amino acid into *glycosis*, as it happens with *glycerol* (Wilmore e Costil, 1999; Roberts e Robergs, 2002). Obviously this is not what the subject who practises body-building wants, since he/she has the objective of hypertrophy.

Note that, although this can not be happening since the metabolic activity is controlled by glycaemia, it has not fallen to values near *hypoglycaemia*, even though the exercise was carried out after 6 or 7 hours of fasting. The explanation to this states that since the resistance exercise is an *glycolitic* activity, part of its great muscle production of *lactato* will be addressed to the liver in order to sustain the *glycogenesis* process. That is, the resistance exercise represents pontentially the increase or maintainance of glycaemia.

According to Dâmaso (2001) the *lactato* which comes from the "**bony muscles**" is the first precursor of glycogenesis. It is converted into *glycosis* in a process called Cori Cycle (Guyton, 1998). This way, the *lactato* may be considered the main substract of glycogenesis during a resistance exercise session.

This explanation is confirmed with data obtained from long distance runners, in who the *lactato* production is fewer due to a more aerobic acitivity. The glycaemia must led to the counter-regulating hormonal activity (Silva et al, 2004)).

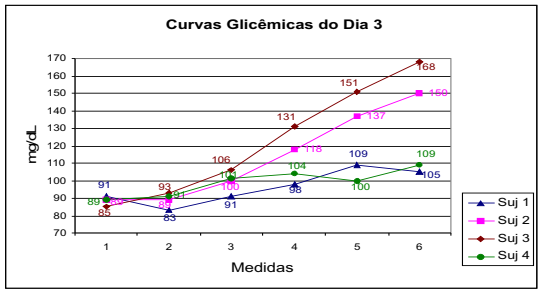
On the second day of the procedure, the glycaemia has been slightly increased in relation to Day 1. The resting average for the five ratings taken during the exercise were: 95.3; 91.3; 93.3; 93.0; 95.3 e 96.3 mg/dl . Graphic 2 presents the glycaemic behaviour on Day 2 individually. The sample shows the exercise in a similar situation to Day 1, with an increment of a 30-minute-snack before the trainment. The glycaemic behaviour was quite the same, it is possible to note a small increase in the values as a consequence of the snack. It is important to highlight that this snack does not promote significant differences in the glycaemic metabolism in relation to the exercise taken in fasting conditions.



Graphic 2: Glycaemic behaviour towards a 30-minute-snack before trainment

On Day 3 the subjects took supplement based on *maltodextrine* during the trainment. It resulted into an increment of glycaemia for all the subjects as the trainment was going on, with average resting values and exercises in: 88.5; 89.0; 99.3; 112.8; 124.3 and 135.5 mg/dl . This is seen in Graphic 3. Two of four subjects were quite responsive to the supplement during the exercise, and all of them had increments in the glycaemia.

Graphic 3: Glycaemic behaviour in the resistance exercise with maltodextrine supplment



It has been noticed that the glycogenic activity, common to this type of trainments, was added to the absortion of *glycosis* in order to produce this glycaemic increment. This behaviour may lead to two interpretations: 1 The carbohydrate supplement might not be necessary during the resistance exercise, contradicting what has been verified in the continuum aerobic exercise (Silva, et al, 2004). 2 There is an opportunity to question the benefits of such supplement during trainment, since the high glycaemia favours the secretion of some hormones that hold essential roles in the hypertrophy mechanism (Gentil, 2005).

This two interpretations may need consideration due to the fact that the glycaemic behaviour is a pontential factor in the modulation of metabolism, although it does not do it directly but with estimulation or inibition of some hormones' activities. Since this research has only studied the glycaemic behaviour, the colected data should be confirmed with forthcoming research that also monitores the activity of such hormones as well as glycaemia.

It stands out also that, though the glycaemic behaviour has followed a standard, i.e., decrease in the beginning of the exercise and increase in the end to the procedures of Days 1 and 2, and current increase to Day 3, this study points out that this answer may occur in an individual way. For instance, Graphic 3 shows that all individuals had increased glycaemia, but within different magnitudes. This way, similar research using a bigger sample is necessary to confirm this data.

CONCLUSION

This research has shown that, in spite of great *glycolitic* activity that takes place in the resistance exercise, the glycaemia does not decrease to values near *hypoglycaemia*, in a way that the activation of hormonal counter-regulating activity should not occur. Proteolysis elapsing from this hormonal activity would be left off for such type of exercise. On the other hand, the carbohydrate supplement at the moment of the trainment promotes significant metabolic elevations. Studies with bigger samples, as well as monitor of the *seric* concentration of some hormones are important in order to better throwing light on the presented data in this study.

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GLYCAEMIC BEHAVIOUR WITHIN RESISTANCE EXERCISES IN DIFFERENT MOMENTS AFTER INGESTING CARBOHYDRATES

ABSTRACT

This research aims at investigating the glycemic answer to a session of resistance exercises under three food ingestion conditions, as it follows: one session after six hours without any meal (Day1), a second session starting 30 minutes after a snack (Day2) e the third session within six hours without any meal but carbohydrate supplements during trainment (Day3). The sample was constituted by four boys of the age group between 18 and 25 years old who have been practicing body building aiming at hypertrophy. They took a trainment which encompasses ten exercises and had their glycaemic index rated before and after every two exercises which were carried out. The equipment used was a *glycosimetre ACCU-CHEK ADVANTAGE* from Roche Diagnostics. Data were analysed concerning descriptive estatistics, using the Excell Software 2000. In the situations on Day1 (108.8; 95.6; 104.3; 101.8; 103.5 e 104.3 mg/dl) e Day2 (95.3; 91.3; 93.3; 93.0; 95.3 e 96.3 mg/dl), the average values of the glycaemia decreased while the first rating and increased during the forthcoming ratings which are brought near to resting values. On Day3, the glycaemia went up during the whole exercise, and by the end of the session the values were quite high in relation to resting (88.5; 89.0; 99.3; 112.8; 124.3 e 135.5 mg/dl). In none of the cases the glycaemia reached values which were closer to hypoglycaemia (60 70 mg/dl). In conclusion, the resistance exercise does not call forth high decrease in the glycaemia, probably because the *lactato* produced during the practise of activities is being used in the *glyconeogenesis* to maintain the glycaemia with elevated values during the practise of body building. This maintainance of glycaemia may be obstructing the proteolysis process even though the trainment is taken in a fasting situation.

Key words: resistance training, hypoglycaemia, counter-regulating hormones, proteolysis, *lactato* and *glyconeogenesis*

LE COMPORTEMENT GLYCÉMIQUE DANS LA RÉSISTANCE S'EXERCE DANS DIFFÉRENTS MOMENTS APRÈS L'INGESTION d'HYDRATES DE CARBONE

RÉSUMÉ

Cette recherche vise à étudier la réponse glycémique à une session des exercices de résistance dans trois conditions d'ingestion de nourriture, car elle suit : pendant une session après six heures sans n'importe quel repas (Jour1), une deuxième session commençant 30 minutes après un casse-croûte (Jour) e la troisième session dans un délai de six heures sans n'importe quel repas mais l'hydrate de carbone complète pendant le trainment (Jour3). L'échantillon a été constitué par quatre garçons de la catégorie d'âge entre 18 et 25 ans de qui avaient pratiqué l'hypertrophie visante de bâtiment de corps. Ils ont pris un trainment qui entoure dix exercices et ont eu leur index glycémique ont évalué avant et après chaque deux exercices qui ont été effectués. L'équipement utilisé était un AVANTAGE du glycosimetre ACCU-CHEK de diagnostic de Roche. Des données ont été analysées au sujet de l'estatistics descriptif, en utilisant le logiciel 2000 d'Excell. Dans les situations le jour 1 (108.8 ; 95.6 ; 104.3 ; 101.8 ; 103.5 e 104.3 mg/dl) e Jour2 (95.3 ; 91.3 ; 93.3 ; 93.0 ; 95.3 e 96.3 mg/dl), les valeurs moyennes du glycaemia diminuées tandis que la première estimation et accrues pendant les prochaines estimations qui sont apportées près aux valeurs de repos. Le Jour3, le glycaemia est allé vers le haut pendant l'exercice entier, et vers la fin de la session les valeurs étaient tout à fait hautes par rapport au repos (88.5 ; 89.0 ; 99.3 ; 112.8 ; 124.3 e 135.5 mg/dl). Dans aucune des caisses le glycaemia a atteint les valeurs qui étaient plus près de mg/dl de la hypoglycémie (60 - 70). En conclusion, l'exercice de résistance n'appelle pas en avant la diminution élevée du glycaemia, probablement parce que le lactato produit pendant pratiquent des activités est employé dans le glyconéogenèse pour maintenir le glycaemia avec des valeurs élevées pendant pratiquent du bâtiment de corps. Ce maintainance de glycaemia peut obstruer le processus de protéolyse quoique le trainment soit pris dans une situation de jeûne.

Mots clés : résistance, hypoglycémie, hormones derégulation, protéolyse, lactato et glyconéogenèse

EI COMPORTAMIENTO GLYCAEMIC DENTRO DE LA RESISTENCIA EJERCITA EN DIVERSOS MOMENTOS DESPUÉS DE INJERIR CARBOHIDRATOS

EXTRACTO

Esta investigación tiene como objetivo el investigar de la respuesta glycemic a una sesión de los ejercicios de la resistencia bajo tres condiciones de la ingestión del alimento, pues sigue: una sesión después de seis horas sin ninguna comida (Día1), una segunda sesión que comienza 30 minutos después de un bocado (Día2) e la tercera sesión en el plazo de seis horas sin ninguna comida solamente el carbohidrato suple durante el trainment (Día3). La muestra fue constituida por cuatro muchachos de la categoría de edad entre 18 y 25 años de viejo quiénes han estado practicando la hipertrofia que tenía como objetivo del hipertrofiar el cuerpo. Tomaron un trainment que abarca diez ejercicios y tenían su índice glycaemic clasificado antes y después cada dos ejercicios que fueron realizados. El equipo usado era una glycosimetre ACCU-CHEK del Roche.Diagnostic Los datos fueran analizados referentes a estatistics descriptivo, usando el software 2000 de Excell. En las situaciones el el Día1 (108.8; 95.6; 104.3; 101.8; 103.5 e 104.3 mg/dl) e DIA2 (95.3; 91.3; 93.3; 93.0; 95.3 e 96.3 mg/dl), los valores medios del glycaemia disminuidos mientras que el primer grado y crecientes durante los grados próximos que se traen cerca a los valores de reclinación. El el Día3, el glycaemia fue para arriba durante el ejercicio entero, y para el final de la sesión los valores eran absolutamente altos en lo referente a la reclinación (88.5; 89.0; 99.3; 112.8; 124.3 e 135.5 mg/dl). En ningunos de los casos el glycaemia alcanzó los valores que estaban más cercano a mg/dl de la hipoglucemia (60 - 70). En la conclusión, el ejercicio de la resistencia no llama adelante la alta disminución del glycaemia, probablemente porque el lactato producido durante practica de actividades se está utilizando en la gliconeogénesis mantener el glycaemia con valores elevados durante practica del edificio del cuerpo. Este maintainance del glycaemia puede obstruir el proceso del proteolysis aunque el trainment se toma en una situación de ayuno.

Palabras claves:treinamento de resistencia, hipoglucemia, hormonas de contador-regulacio'n, proteolysis, lactato y gliconeogénesis

COPORTAMENTO GLICÊMICO EM SESSÕES DE EXERCÍCIOS RESISTIDOS EM DIFERENTES MOMENTOS APÓS A INGESTA DE CARBOIDRATOS

RESUMO

Esse estudo teve como objetivo investigar a resposta glicêmica a uma sessão de exercício resistido sob três condições de ingesta alimentar, sendo uma após 6 horas sem qualquer aimentação (DIA1), a segunda com a sessão iniciando após 30 minutos de um lanche (DIA2) e a terceira com 6 horas sem alimentação, mas com suplementação de carboidrato durante o treino (DIA3). A amostra foi constituída por 4 rapazes na faixa etária de 18 a 25 anos que praticavam musculação com objetivo de hipertrofia. Eles realizaram um treinamento constituído por 10 exercícios e tiveram a glicemia medida antes e a cada dois exercícios realizados. O aparelho usado foi um glicosímetro ACCU-CHEK ADVANTAGE da Roche Diagnóstics. Os dados foram analisados por meio de estatística descritiva, utilizando-se o software excel 2000. Nas situações DIA1 (108.8; 95.6; 104.3; 101.8; 103.5 e 104.3 mg/dl) e DIA2 (95.3; 91.3; 93.3; 93.0; 95.3 e 96.3 mg/dl), os valores médios da glicemia mostraram queda na primeira medida e aumentos nas medidas posteriores para valores próximos aos de repouso. Na situação do DIA 3, a glicemia subiu durante todo o exercício, terminando com valores bastante superiores aos de repouso (88.5; 89.0; 99.3; 112.8; 124.3 e 135.5 mg/dl). Em nenhum dos casos a glicemia chegou a valores próximos de hipoglicêmico (60 70 mg/dl). Conclui-se que o exercício resistido não provoca queda acentuada da glicemia, provavelmente porque o lactato produzido durante a prática dessa atividade seja utilizado na gliconeogênese para manter a glicemia em valores elevados durante a musculação. Esta manutenção da glicemia pode estar impedindo processos de proteólise mesmo durante o treinamento realizando em situação de jejum.

Palavras Chaves: Exercício resitido, Hipoglicemia, Hormônios Contrarreguladores, Proteólise, Lactato e Gliconeogênese.