THE RELATIONSHIP BETWEEN OBESITY AND POSTURAL CONTROL IN CHILDREN AND ADOLESCENT

Najada Quka[1], Arben Kaçurri[2]

[1]Sports University of Tirana, Tirana, Albania, E mail: nquka@ust.edu.al
[2]Sports University of Tirana, Tirana, Albania, E mail: akacurri@ust.edu.al

Abstract

As the obesity epidemic grows, newer studies will be needed to help everyone who is faced with or has the attendance to become obese, to fully understand the true impact of obesity on their daily life activities facilitating social integration and preventing other negative consequences of obesity in children life. Balance is a requisite component for successful completion of functional activities including locomotors and manipulative skills. Examination of balance in children is important in physical therapy to predict their safety in variety of environment. The objective of this Meta analysis study was to analyze the current literature related to the effects of obesity on postural stability (balance). This meta-analysis also supports the efficacy of reducing obesity for better balance by increasing children and adolescent locomotors performance. In this study are tracked down 25 published studies focused in the consequences of childhood obesity in postural stability. These effects were observed during conditions of static balance and dynamic balance during gait. Postural stability was investigated in children and adolescents by facing them not only with normal conditions but even with altered sensory conditions. We used Pub Med research, where the main focus was on those research articles that display the significant evidences due to our question. The results of this paper are: 1) Increased spontaneous sway in static standing has been observed in boys who are obese and aged 8 to 10 years and in teens that are obese, when compared with peers of normal weight. 2) Significant differences in reaction time and LOS between obese and athletes revealed that in physiotherapy of obese children, physical activities need to be focused on improving the overall posture and postural ability. 3) Obesity may affect children motor performance because of the required aim to lift their body mass. The existing literature provides evidences for a strong correlation between obesity and balance impairments in children but what we have seen during our study is the lack of data related to the consequences of childhood obesity on the development and function of the musculoskeletal system. Being aware about consequences of obesity despite of many other chronic diseases, our further studies will be focused more over its negative impacts on postural control to prevent daily life activities deficits.

Keywords: *Obesity, postural control, children*

Introduction

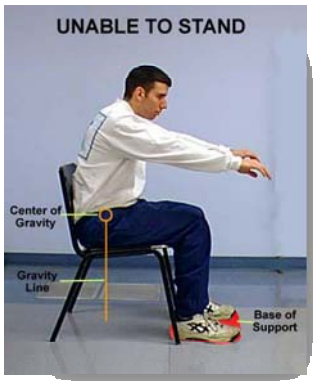
As the obesity epidemic grows, newer studies will be needed to help everyone who is faced with or has the tendency to become obese, in order to fully understand the true impact of obesity on their daily life activities. Obesity is considered to be a great risk factor in heart disease, diabetes and some type of cancer. Despite of that significantly increased body weight is shown to be a critical part of balance stability because of biomechanical constraints resulted from being obese. (Etelson D et al, 2003; Daniels S.R, 2006; Browning, R.C, 2012).

Postural control is an important part of everyday life for both children and adolescent.

"Balance as equilibrium means having the ability to maintain centre of mass within to base of support in order to orient and align the body in space." (Fig.1)

Fig.1

Balance is a requisite component for successful completion of functional activities including locomotors and manipulative skills. (Dokić, Z & Mededović B, 2013). Furthermore balance is necessary even to execute a simple basic physical movement such as "standing" which may be difficult if CoM is not adequately felt within base of support. (Hills A.P & Parker A.W 1991). (Fig.2 and Fig .3)



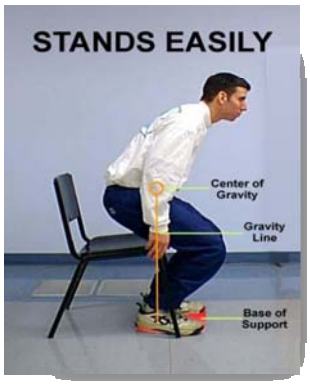


Fig.2 Fig.3

Examination of balance for obese children is important in physical therapy in order to predict their safety in variety of environment preventing the possibility to fall. Safety especially for obese children is very important motivating them due to increased physical participations. (Corbeil P.H et al, 2001)

gure 2. Subject's position on the force platform (model BIOMEC40

Aim

The objective of this Meta analysis *was to analyze the current literature related to the effects of obesity on postural stability (balance).* Also it supports the efficacy of reducing obesity for better balance by improving motor skills in children and adolescent

Methods

We used *Pub Med to gather those* research articles that display the significant evidences due to the relationship:

- ✓ *between excessive body weight on static and dynamic stability*
- ✓ *postural control in normal and altered sensory conditions, differences in balance*

In this study are tracked down *25 published studies (1.7 – 3.4 impact factor)* focused in the *consequences of childhood obesity in postural stability.* These effects were observed during conditions of *static balance, perturbed balance and dynamic balance.* Postural stability was investigated *in children and adolescents* by facing them not only with normal conditions but even with altered sensory conditions.

Results

1) 46.6 % of articles included in this meta-analyses *revealed a strong link between obesity and postural stability, because of biomechanical constraints resulted by excessive body weight in children and adolescent.* These emphasised the fact that obesity may affect the balance by displaying significant difficulties on postural control in daily life activities

Biomechanical constraints resulted from excessive body weight.

- ➢ Contrary to basic determination of what balance means, it is indicated that obese body's balance is compromised leading people to a force-compensation pattern causing small spontaneous sway in body movement when maintaining a posture. (Davids. K et al 2000)
  ** Center of mass falls outside of the body's base support*
- ➢ There are data illustrating existence of negative impact of obesity related to Range of Motion (ROM), which is not only an important aspect of functional movement, but this functional impairment *may influence the ability to maintain and recover balance* presenting the most significant balance challenge compare to normal weight children. (Greve.J et al 2007)
- ➢ McGraw. B et al (2000) revealed that *because of biomechanical adaptations to obesity in order to maintain balance, many gait variables (speed and cadence) are impaired.*

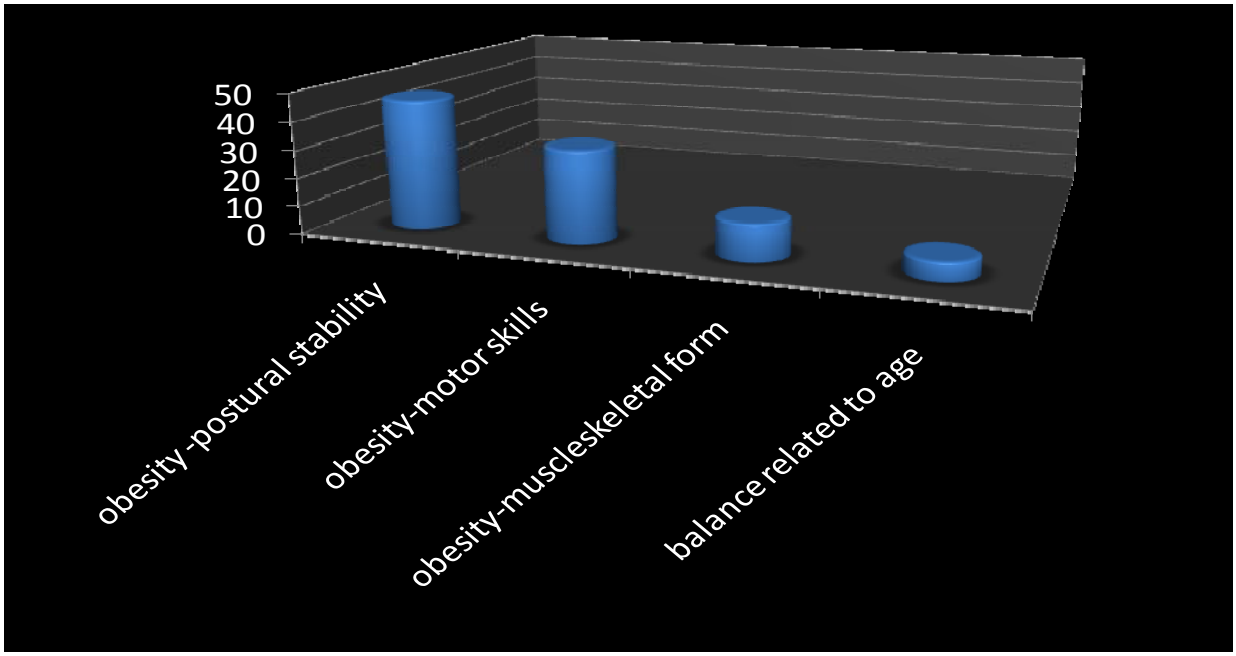
2) 33.3 %of articles shown the impact of obesity in reduction of perceptual motor coordination inducing obese children due *to lack motor skills*.

- ➢ Increased body weight and mass *modify how the limbs and whole body create and react to forces, demonstrating difficulty in bending, kneeling, lifting and carrying.* Problems with executing these basic physical tasks create limitations in performing basic activities of daily living. (Deforche. B et al 2000; Larsson U & Mattsson E, 2001; Graf. C et al 2005; Graf .C et al, 2004)

- Balance is the state of equilibrium and in practice, for obese children, it means not only maintenance of balance but even the management of their excessive body weight, affecting negatively their motor performance. (Pastucha. D et al 2012)
- Obesity also increases the need for attention resources to maintain postural stability which may lead to compromised *balance especially when subjects are required to maintain stability* during multi-task performing. (D'Hondt. E et al 2008, 2009)

3) 13.3 %of articles included in this meta-analysis which were review articles underlined *the existence of lack data regarding the negative effects of obesity in muscular-skeletal development in growth age.* (Chan G & Chen Ch. T, 2009; Wearing, S. C et al 2006).

4) 6.6 % of studies shown no strong correlation between obesity and postural control b*ecause of less challenge foot position by measuring only static balance, excluding dynamic stability.*



Graphic Nr. 1, Correlation between obesity and postural stability.

Discussion and Conclusion

- Based on all the data illustrated in this meta-analysis, it is clearly shown that functional and structural impairments resulted or caused by obesity *affects children's basic daily life activities.* (Mignardot J.B et al, 2010 & 2013; Teasdale. N et al, 2013).
- According to several consequences of obesity such as reduced ROM and impairment of many gait variables we can say that the ability to maintain balance would be *the most*

difficult thing for children if excessive weight continues to dominate in their life. (Shultz S. P et al 2011)

- In addition to those research articles which underline the relationship between obesity and postural stability problems, there are evidences showing the efficacy of weight loss program as a balance intervention. (Del Porto. H et al 2012).

There are evidences indicating significant improvements in time of balance maintenance and postural sway especially for those who engaged in a *combination of both intervention methods*:

a) Weight loss *(DIET)*

b) Balance and functional training

There are limited available researches suggesting that although weight loss alone may positively influence postural balance. (Larsson U & Mattsson, E, 2003; Maffiuletti N.A et al 2005)

But effects of combination intervention methods are more significant because it improves balance and recovery ability reducing the risk of falls and fracture in obese children and adolescents.

Protocols of both methods used as balance intervention must be matched with individual characteristics in order to predict maximal changes. Below is presented an example of training protocol duration regarding significance of training benefits produced. In this meta-analysis are included 7 research articles from 1969-1980. (Fig. 4)

According to this example of "training protocol duration" for maximum benefits by Zwiren at 1989 it is revealed that 8 or 9 weeks of training are not constructive to meet significant changes. Protocol of training, at least should last 12 weeks to identify changes and for significant improvements is recommended 7 months of specific training and more regarding the basic purpose of training application. (Cited on Book – Human Kinetics, "Life Span Motor Development" 6th Edition).

The negative results reported in this meta-analysis about no changes shown not only after 12 weeks of training but even after 14 months, underline the fact that protocol used wasn't matched with structural and functional characteristics of subjects.

In this meta-analysis is clearly shown the importance of individual characteristics related to effectiveness of protocol used.

Fig. 4.An example of training protocol duration for maximal benefits
(A Meta- Analyses)

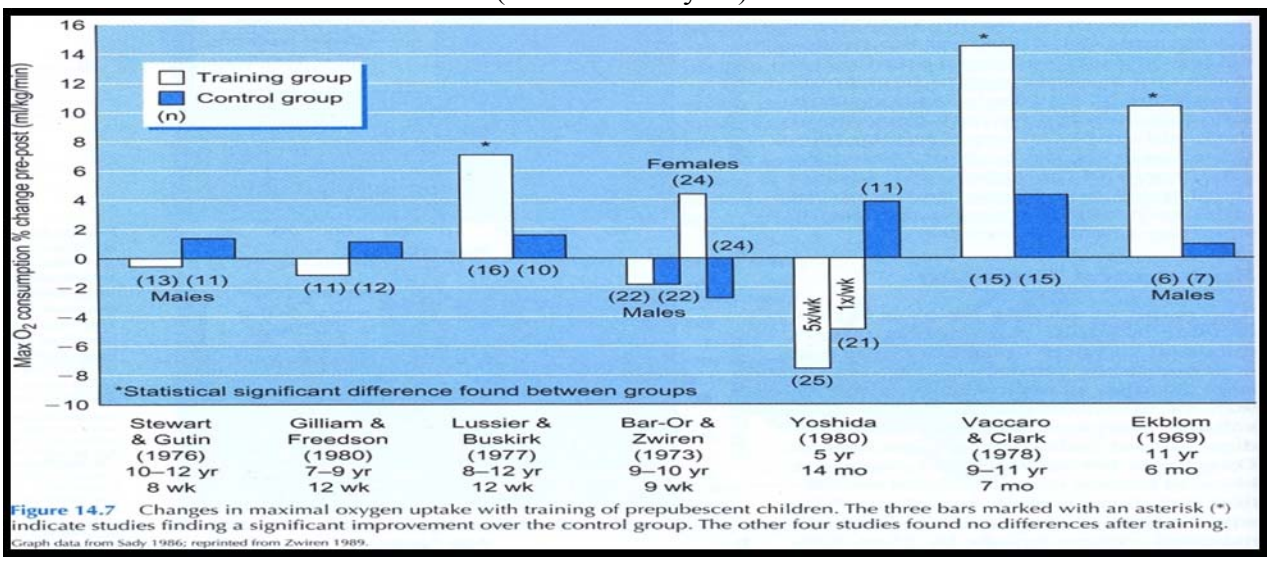


Figure 14.7 Changes in maximal oxygen uptake with training of prepubescent children. The three bars marked with an asterisk (*) indicate studies finding a significant improvement over the control group. The other four studies found no differences after training.
Graph data from Sady 1986; reprinted from Zwiren 1989.

As literature reported, there is *a strong correlation between obesity and balance impairments* in children but what we revealed during our study *is the lack of data related to the consequences of childhood obesity on the development and function of the musculoskeletal system.*Based on recent findings related to numerous co-morbid conditions resulted by excessive body mass, emerging promotions are needed to prevent obesity for each age category.

Further Implication

At the end of this meta-analysis we suggest that further studies will be focused on identification of negative impacts of obesity on postural control (balance) to confirm the reliability of relationships noted in this Meta analyses and to explore about the efficacy of weight loss interventions and their potential due to reduction of balance impairments caused by excessive weight for a better later life.

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