The journal « The challenge »: ISSN 9859-1112EISSN2602-6619
Vol:13 Issue:02/2021, Pages 68-79

The effects of physical activity and diet on reducing the body mass index in Adolescent: systematic review.

آثار النشاط البدني والنظام الغذائي على خفض مؤشر كتلة الجسم لدى المراهقين: مراجعة منهجية

Guebli Abdelkader [*1]Francisco Jeci de Holanda[2], Noureddine Zabchi[3], SahiOualdiBouchra[4]

[1] APSSEH Laboratory, Institute of Physical Education and Sports, Hassiba Benbouali University of Chlef, Algeria, abdelkader85@windowslive.com.

[2] Department of Physical Education, UNIPLAN, Brazil, holandajeci@bol.com.br.

[3] EPS Institute, University of Mostaganem, Algeria; norzabchi7@yahoo.fr.

[4]DjillaliLiabes University of Sidi Bel Abbes, Algeria;b.sahioualdi@gmail.com

Received: 09/05/2020 Accepted: .../…/2020Published: …. /…/2020

Abstract:

The aim of study was to review randomized controlled trials of the long-term effectiveness of physical activity and diet in terms of effect on BMI in Adolescent.Data for systematic review was collected via a search of databases PubMed, PMC and ScienceDirect for literature published between 2000 and 2020 .The studies showed that dietary and Physical activity behaviors are interrelated, it is suggested that Physical activity is taken into account when examining the benefits of health enhancing dietary behaviors and vice versa. the practicing physical activity that accompanies a good diet gives very positive results. In contrast, exercising physical activity with irregular diet has weaker results in reducing BMI. Also, the diet alone can decrease the BMI, provided that the level of movement activity practiced during daily life is maintained, But the pace of decline in BMI will be very slow. According to this systematic review, Professional support should be provided regarding nutrition and related matters, we should encourage adolescences to do more physical activity and equipment should be provided to help attain this goal. Such precautions are necessary to create a healthy society, families should be educated in this matter as well.

Keywords: Physical Activity; Diet; Body Mass Index; Adolescent.

ملخص:

كان الهدف من الدراسة هو مراجعة التجارب المعشاة ذات الشواهد حول الفعالية طويلة المدى للنشاط البدني والنظام الغذائي من حيث التأثير على مؤشر كتلة الجسم لدى المراهقين. تم جمع البيانات للمراجعة المنهجية عبر البحث في قواعد البيانات PubMed و PMC و ScienceDirect للأدب المنشور بين عامي 2000 و 2020. أظهرت الدراسات أن السلوكيات الغذائية والنشاط البدني مترابطة ، ويقترح أن يتم أخذ النشاط البدني في الاعتبار عند دراسة فوائد السلوكيات الغذائية المعززة للصحة والعكس صحيح. إن ممارسة النشاط البدني المصاحب لنظام غذائي جيد يعطي نتائج إيجابية للغاية. في المقابل ، فإن ممارسة النشاط البدني مع اتباع نظام غذائي غير منتظم يؤدي إلى نتائج أضعف في تقليل مؤشر كتلة الجسم. أيضا ، يمكن للنظام الغذائي وحده أن يقلل من مؤشر كتلة الجسم ، بشرط الحفاظ على مستوى النشاط الحركي الذي يمارس خلال الحياة اليومية ، لكن وتيرة الانخفاض في مؤشر كتلة الجسم ستكون بطيئة للغاية. وفقًا لهذه المراجعة المنهجية ، يجب تقديم الدعم المهني فيما يتعلق بالتغذية والمسائل ذات الصلة ، ويجب أن نشجع المراهقين على القيام بمزيد من النشاط البدني ويجب توفير المعدات للمساعدة في تحقيق هذا الهدف. هذه الاحتياطات ضرورية لخلق مجتمع صحي ، ويجب تثقيف الأسر في هذا الأمر أيضًا.

الكلماتالدالة: النشاط البدني؛ النظام الغذائي؛ مؤشر كتلة الجسم المراهقة.

Corresponding author: Guebli Abdelkader E-mail: abdelkader85@windowslive.com

The effects of physical activity and diet on reducing the body mass index in Adolescent: systematic review.

1. Introduction :

Scientific evidence indicates that regular physical activity, exercise, and fitness are a key determinant of health. Appropriate dose of regular physical activity, participation in sports provides male and female of alleges, including those with disability (Abdelkader et al., 2020; Guebli et al., 2020), with physical and mental health benefits, as well as with social relationships (Bhuiyan et al., 2020; Kruk, 2009). Physical activity is a cheap and strong means for prevention of diseases, improvement health and well-being, and it also promotes integration and social interaction (WHO, 2003). Over the past half century researchers have provided evidence that being physically inactive or unfit has major negative health consequences throughout the lifespan (Sallis et al., 2012; Ortega et al., 2008). Although the physical and mental health benefits of regular physical activity participation have been well documented (Gu et al., 2016; Janssen & LeBlanc, 2010; Ströhle, 2009), it is estimated only 23% of children and adolescent meet minimum recommended activity levels, and physical activity actually declines with age (Tremblay et al., 2014). Physical activity in adolescence may contribute to the development of healthy adult lifestyles, helping reduce chronic disease incidence.(Hallal et al., 2006). Thus, there is an indirect effect on all health benefits resulting from adolescent physical activity.

Adolescence is the period of transition from childhood to adulthood or maturity. It occurs between the ages of ten and 19, beginning with the appearance of secondary sexual characteristics, and ending with emotional maturity and cessation of growth. Adolescence is characterised by rapid physical, psychological and social changes and is when individuals become capable of reproduction (ALBashtawy, 2017; La Guardia & Ryan, 2002; Brettschneider, 1992). However, definition of the optimal amount of physical activity in adolescence requires addressing a number of scientific challenges.

In 2002, the World Health Organization listed physical inactivity as one of 10 powerful risk factors for premature death (WHO, 2003). The importance of participation in physical activity regularly for health and well-being is accepted by much of the general population. Nevertheless, the majority of people, especially in industrialized countries, achieve sedentary or insufficient levels of physical activity. Professor Steven Blair (2009) maintains that "physical inactivity is one of the most important public health problem of the 21st century, and may even be the most important "(Blair, 2009; Haskell et al., 2009).

Complete assessment of physical activity irrespective of its type must include three its components: frequency, duration and intensity (Kim et al., 2017; Kruk, 2009), Frequency describes the number of times that the activity is undertaken in a given period, Duration informs about the total time spent in activity during the same period, and Intensity describes the amount energy expenditure by a person during the activity. In addition, the intensity of physical activity is often stratified into three levels : light (<3METs), moderate (3-6.0 METs) or vigorous (>6 METs). One MET, a metabolic equivalent of energy expenditure, is the energy expended during sitting quietly. This unit is equivalent to an oxygen uptake of 3.5 mL per kilogram of body weight per minute for an adult weighting 70 kg (Kruk,

Corresponding author: Guebli Abdelkader **E-mail:** abdelkader85@windowslive.com

2009; Rejeski& Mihalko, 2001; Ainsworth et al., 1993). The MET value defines the ratio of the metabolic rate of an activity to the resting metabolic rate.

Cross-sectional studies are generally in agreement that dietary is positively associated with relative weight and BMI, whereas the prospective studies of diet in relation to weight change give inconsistent results (Huang et al., 2005; Lissner&Heitmann, 1995). The reasons for this inconsistency are not clear. However, given the complexity of body weight regulation, these inconsistent endings may be caused by a host of known and unknown factors, ranging from genetic and metabolic factors to the behavioral factors such as dieting in response to weight gain and BMI (Lissner&Heitmann, 1995; Mustelin et al., 2009), defined as using self-reported height and weight to calculate BMI. Furthermore, the studies of diet and BMI are complicated by the difficulty in measuring dietary intake of a free-living population, resulting in measurement errors in dietary data. These errors may be caused, for example, by the under-reporting of intake by some overweight individuals9 and by the daily variation in food intake of the same individual (Mõttus et al., 2013; Paeratakul et al., 1998).

In this systematic review, we examined the relationship between physical activity, and body mass index (BMI), taking into account diet factor. Data for analysis came from databases search PubMed, PMC and ScienceDirect for literature published between 2000 and 2020.

2. Material and method

This study can be characterized as an explanatory mixed-methods study following a dominant-status sequential design(Abdelkader et al., 2018; Rudd & Johnson, 2010). A mixed-methods approach is favored in research contexts where the constructs of interest are ambiguous and have not been investigated extensively(David et al., 2018). Moreover, mixing both quantitative and qualitative instruments serves to improve the validity of the research findings and enables researchers to make causal inferences (Rudd & Johnson, 2010).

2.1. Data Source :A literature search was undertaken using PubMed, PMC and ScienceDirect in November 2020, using search terms ‘Physical activity’, ‘body mass index (BMI)’, and 'Diet’. Reviews and key articles published in English since 2000 were used to present established knowledge and set the background context, while to identify recent updates the search was reduced to articles published after each year in a row until 2020. These results filtered using the terms ‘Human’ and limited to English language publications. The abstracts of these articles were then evaluated and studies included if the main focus was an exercise intervention and Diet study on BMI control. Titles were manually sorted and articles rejected if primary objectives were not exercise and practice-based. They were then divided on the basis of whether they assessed the acute responses that occur during or immediately after a practice of Physical activity, or the chronic adaptations that occur over a more prolonged period of time due to repeated exercise bouts—the practicing effects. the aforementioned sorting produced the resultant total of articles which are summarised in tables 1 and 3.

2.2. Data analysis: The obtained data were analyzed by using a software Excel 2019, we used percentage to analyze the data.

Corresponding author: Guebli Abdelkader **E-mail:** abdelkader85@windowslive.com

3. Results

In presenting this review, the authors acknowledge the growing evidence for the advantageous effects of Physical activity practicing and diet on BMI, and that this aspect of behavior needs to be considered in the wider context of personal health and BMI. Likewise, that Physical activity may benefit the patients with a number of chronic disease conditions, such as diabetes and obesity ... etc. But due to word limits, these scenarios maybe were beyond the scope of this review.

Table 1. Statistical description of studies ratios including Physical activity, Diet and BMI variables in the last 10 years on the databases PubMed, PMC and ScienceDirect.

The years	Physical Activity	BMI	Diet	All Variables
2020	%4.44	%4.58	%3.76	%5.38
2019	%6.15	%7.10	%5.47	%8.24
2018	%5.62	%6.59	%5.11	%7.32
2017	%5.25	%6.05	%4.70	%6.53
2016	%4.93	%6.05	%4.59	%6.37
2015	%4.76	%5.74	%4.27	%6.15
2014	%4.40	%5.40	%4.08	%5.54
2013	%4.10	%5.08	%3.88	%5.38
2012	%3.73	%4.56	%3.48	%4.76
2011	%3.39	%4.36	%3.33	%4.33
2010	%3.12	%4.12	%3.00	%3.69
2009	%3.07	%3.96	%3.04	%3.66
2008	%2.85	%3.58	%2.88	%3.30
2007	%2.74	%3.12	%2.66	%3.24
2006	%2.52	%2.85	%2.40	%2.89
2005	%2.30	%2.44	%2.22	%2.60
2004	%2.05	%2.05	%1.91	%2.10
2003	%1.90	%1.82	%1.94	%1.74
2002	%1.59	%1.27	%1.50	%1.24
2001	%1.54	%1.17	%1.45	%0.99
2000	%1.45	%1.23	%1.44	%0.96

Table 1 presents the descriptive statistics of studies ratios including Physical activity, Diet and BMI variables in the last 10 years on the databases PubMed, PMC and ScienceDirect. These studies ratios were extracted on basis of the studies number in the above-mentioned databases from the total studies included in these databases. It is noted through this the increase the studies ratios are concerned with the topics of Physical activity, diet and BMI. As shown these Table, the studies ratio that including Physical activity, Diet and BMI variables experiencing a gradual increase in the last 10 years on the databases PubMed, PMC and ScienceDirect, especially from 2009 to 2019 (Fig.1)

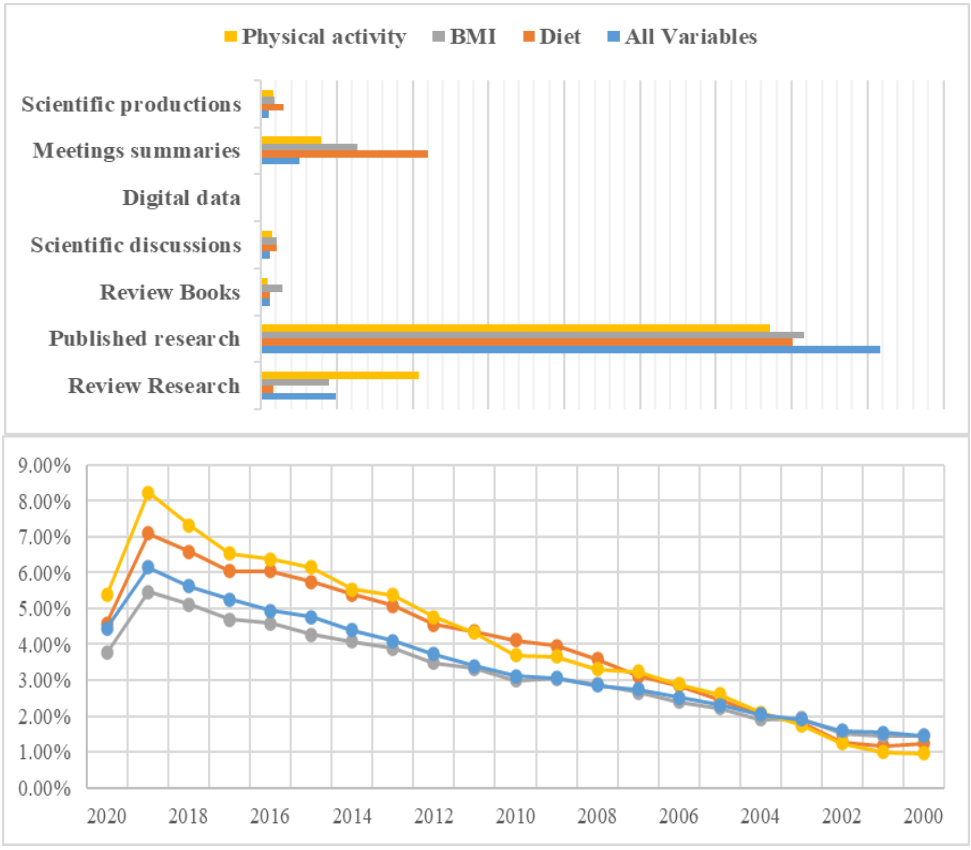
Corresponding author: Guebli Abdelkader **E-mail:** abdelkader85@windowslive.com

Table 2. Classification of studies ratios according to types papers scientific

	Physical activity	BMI	Diet	All Variables
Review Research	%9.94	%1.58	%9.01	%20.89
Published research	%81.63	%70.17	%71.56	%67.19
Review Books	%1.16	%1.24	%2.83	%0.82
Scientific discussions	%1.13	%2.09	%2.10	%1.48
Digital data	%0.02	%0.02	%0.04	%0.01
Meeting's summaries	%5.12	%21.99	%12.71	%7.95
Scientific productions	%1.00	%2.91	%1.75	%1.66

Table 2 presents the classification of studies ratios according to types papers scientific that including PA, Diet and BMI variables in the last 10 years on the databases PubMed, PMC and ScienceDirect. Published researches ratio, in variables of practice PA, BMI as well as diet showed a high value 81.63%, 70.17%, 71.56% respectively. in addition, the ratio 67.19% for all variables in Published research type. then the Review Researches ratio 9.94%, 1.58%, 9.01% respectively. with ratio 20.89% for all variables in this type of papers scientific (Fig.1).

Fig.1. Studies ratios including Physical activity, Diet and BMI variables in the last 10 years on the databases PubMed, PMC and ScienceDirect



4. Discussion

The present study revealed the Physical activity practice and diet habits among adolescents which effective on BMI. The high consumption of hydrogenated solid fat as well as deep fried foods is common in lately. For most of the dietary behaviors included in the previous studies, most studies included in the latter review (Newby, 2009) provided evidence

Corresponding author: Guebli Abdelkader **E-mail:** abdelkader85@windowslive.com

for a negative association between dietary behaviors and BMI. dietary behaviors has been linked to better overall nutrition (Albertson et al., 2007; Gross et al., 2004; Jakicic et al., 2018).Similar to most previous studies that have examined the relationship of diet to BMI, adolescents eating breakfast more regularly might overall have more adequate food patterns, which might explain the steady significant inverse relationship with BMI (Nicklas et al., 1998; Savige et al., 2007). where the eating breakfast consistently (across a number of years) may be important for long-term management of body weight (Haerens et al., 2010). although our measures were valid and reliable, the data we collected came from previous reports of Physical activity practice, diet and BMI from adolescents, also, in (Kelishadi, Ardalan, Gheiratmand, Gouya, Razaghi, Delavari, Majdzadeh, Heshmat, Motaghian, Barekati, et al., 2007) BMI may not be the best measure of adolescences adiposity nor the best predictor of adult adiposity.

Furthermore, was that among healthy young adults the inverse relationship between physical activity and BMI in both males and females, whereas physical activity was negatively associated with BMI in females only.(Pietiläinen et al., 2008). Physically active young males may have a large muscle mass, which affects BMI more than females (Berkey et al., 2003; Bruzas& Allison, 2019; Pietiläinen et al., 2008; Yaman, 2009). Physical activity may also reduce body fat, preferentially from the abdominal area. For example, in a small but intensive study where energy balance was held constant, exercise reduced abdominal fat despite unchanged body weight (Moholdt Trine et al., 2018; Söderlund et al., 2009). A possible mechanism for how physical activity reduces the genetic effects on obesity is that it changes the expression patterns of genes regulating weight and adiposity (Terry T.-K. Huang et al., 2003). In addition, when the diet and diet+exercise groups were discussion compared to each other, it was found that weight loss and the decrease in BMI were higher in the diet+exercise group. Regarding the difference between genders, it was found that weight loss of the male was higher than the female(Kelishadi, Ardalan, Gheiratmand, Gouya, Razaghi, Delavari, Majdzadeh, Heshmat, Motaghian, Barekati, et al., 2007) .

Previous studies have been conducted to evaluate the combined effects of dietary control and exercise on lipid profile and body mass index. (Volpe et al., 2008) concluded that a supervised exercise program combined with nutritional modifications was effective in obtaining a significant loss of body weight among sedentary people. Weight-loss interventions using a dietary restriction regime accompanied by participation in exercise is associated with moderate weight loss at 6 months.(Ogden et al., 2002, pp. 1999–2000; PhD et al., 2002; R et al., 2000; Volpe et al., 2008). According to the latest nutritional studies, an advice-only group concerning the reduction of energy intake and exercise-alone played an important role in the weight loss of high lipid profile patients (Bhuiyan et al., 2020). On the other hand, the frequency, but not duration, of sports participation plays a substantial role in weight management for adolescences. PA occurs over in frequency, intensity, time and type dimensions (Martin et al., 2018; Must &Tybor, 2005). also, the low levels of habitual Physical activity are associated with increased BMI (Blackshear &Seyfried, 2021; Murphy et al., 2021).

Physical activity causes favorable changes on lipid profiles and BMI when combined

Corresponding author: Guebli Abdelkader **E-mail:** abdelkader85@windowslive.com

with dietary modification (Mustelin et al., 2009; Umutlu et al., 2018). An exercise program accompanied with dietary control makes the individuals feel psychologically good, healthy, and safe from atherosclerotic risk factors of obesity. Therefore, a diet program in addition to exercise will provide more beneficial results in obese people. Recently (published 2010-2020) studies involving practice Physical activity confirm previous research findings of its efficacy in reducing BMI. A lifestyle incorporating aerobic and anaerobic exercise in Physical activity that complies with the guidelines of being of moderate intensity for at least 45min on 3–5 days per week (Hallal et al., 2006; Hill, 2004; Junger et al., 2019; Kelishadi, Ardalan, Gheiratmand, Gouya, Razaghi, Delavari, Majdzadeh, Heshmat, Motaghian, &Barekati, 2007; Kim et al., 2017; Martin et al., 2018; Must &Tybor, 2005; Sevim, 2002), is associated with reduced BMI and weight control (Caspersen et al., 1985; O'Donovan et al., 2010). Health professions recommend that person should accumulate at least 60 min of daily moderate-to-vigorous physical activity or achieve a certain number of steps per day (15,000 steps for boys and 12,000 steps for girls) (Tudor-Locke, Hart, et al., 2009; Tudor-Locke, McClain, et al., 2009). Moreover, almost all studies have consistently shown that Physical activity practice with diet are powerful correlates of reducing BMI that frequently overwhelm the contribution of all other variables. Acute improvements in BMI occur after a bout of exercise and chronic adaptations are evident from training studies involving interventions undertaken for at least 6 weeks.

5. Conclusion

The unhealthy dietary habits are major threats to the present and future health of this vulnerable age group and are likely to make the community prone to an epic demic of chronic disease over the next years. As our results showed that dietary and Physical activity behaviors are interrelated, it is suggested that Physical activity is taken into account when examining the benefits of health enhancing dietary behaviors and vice versa. In view of the number of subjects studied, we acknowledge that practicing physical activity that accompanies a good diet gives very positive results. In contrast, exercising physical activity with irregular diet has weaker results in reducing BMI. Also, the diet alone can decrease the BMI, provided that the level of movement activity practiced during daily life is maintained, But the pace of decline in BMI will be very slow. Hence, we warn against following an Acute diet. Hence, Professional support should be provided regarding nutrition and related matters; we should encourage adolescences to do more Physical activity and equipment should be provided to help attain this goal. Once adolescences are introduced to a healthier lifestyle, they may maintain the same lifestyle throughout their life. Such precautions are necessary to create a healthy society in which the obesity rate is low. To ensure a healthy next generation, families should be educated in this matter as well.

6. Bibliography :

Abdelkader, G., Madani, R., Adel, B., &Bouabdellah, S. (2018). Sporting events among the disabled between excellence and ideal in motor performance. *International Journal of Physical Education, Fitness and Sports, 7*(3), 66–71. https://doi.org/10.26524/ijpefs1837

Corresponding author: Guebli Abdelkader **E-mail:** abdelkader85@windowslive.com

Abdelkader, G., Madani, R., &Bouabdellah, S. (2020). Kinematical variables analysis of shot-put activity in para athletics (class F32/33) and their relationships with digital level achievement. *International Journal of Sport Exercise and Training Sciences*, *6*(2), 65–72. https://doi.org/10.18826/useeabd.709944

Ainsworth, B. E., Haskell, W. L., Leon, A. S., Jacobs Jr, D. R., Montoye, H. J., Sallis, J. F., &Paffenbarger Jr, R. S. (1993). Compendium of physical activities: Classification of energy costs of human physical activities. *Medicine and Science in Sports and Exercise*, *25*(1), 71–80.

ALBashtawy, M. (2017). Obesity and body image perception among adolescents. *EC Psychology and Psychiatry*, *4*(6), 216–217.

Albertson, A. M., Franko, D. L., Thompson, D., Eldridge, A. L., Holschuh, N., Affenito, S. G., Bauserman, R., &Striegel- Moore, R. H. (2007). Longitudinal patterns of breakfast eating in black and white adolescent girls. *Obesity*, *15*(9), 2282–2292.

Berkey, C. S., Rockett, H. R. H., Gillman, M. W., & Colditz, G. A. (2003). One-Year Changes in Activity and in Inactivity Among 10- to 15-Year-Old Boys and Girls: Relationship to Change in Body Mass Index. *Pediatrics*, *111*(4), 836–843. https://doi.org/10.1542/peds.111.4.836

Bhuiyan, N., Kang, J. H., Papalia, Z., Bopp, C. M., Bopp, M., & Mama, S. K. (2020). Assessing the stress-buffering effects of social support for exercise on physical activity, sitting time, and blood lipid profiles. *Journal of American College Health*, *0*(0), 1–7. https://doi.org/10.1080/07448481.2020.1810055

Blackshear, T. B., &Seyfried, L. (2021). Does Education Close the Black-White Physical Activity and Obesity Gaps? *Journal of American College Health*, *69*(2), 222–226. https://doi.org/10.1080/07448481.2019.1657122

Blair, S. N. (2009). Physical inactivity: The biggest public health problem of the 21st century. *British Journal of Sports Medicine*, *43*(1), 1–2.

Brettschneider, W. D. (1992). Adolescents, leisure, sport and lifestyle. *Sport and Physical Activity: Moving towards Excellence: The Proceedings of the AIESEP World Convention, July 20-25, 1990, Loughborough University, UK.*, 536–550.

Bruzas, M. B., & Allison, K. C. (2019). A review of the relationship between night eating syndrome and body mass index. *Current Obesity Reports*, *8*(2), 145–155.

Caspersen, C. J., Powell, K. E., & Christenson, G. M. (1985). Physical activity, exercise, and physical fitness: Definitions and distinctions for health-related research. *Public Health Reports (Washington, D.C.: 1974)*, *100*(2), 126–131.

David, S. L., Hitchcock, J. H., Ragan, B., Brooks, G., & Starkey, C. (2018). Mixing Interviews and Rasch Modeling: Demonstrating a Procedure Used to Develop an Instrument That Measures Trust. *Journal of Mixed Methods Research*, *12*(1), 75–94. https://doi.org/10.1177/1558689815624586

Corresponding author: Guebli Abdelkader **E-mail:** abdelkader85@windowslive.com

Gross, S. M., Bronner, Y., Welch, C., Dewberry-Moore, N., & Paige, D. M. (2004). Breakfast and lunch meal skipping patterns among fourth-grade children from selected public schools in urban, suburban, and rural Maryland. *Journal of the American Dietetic Association*, *104*(3), 420–423.

Gu, X., Chang, M., &Solmon, M. A. (2016). Physical activity, physical fitness, and health-related quality of life in school-aged children. *Journal of Teaching in Physical Education*, *35*(2), 117–126.

Guebli, A., Reguieg, M., Sba, B., Erkmen, N., &Holanda, F. J. de. (2020). The Modern Technology to Stimulate and Improve Sports Performance for the Paralympic Athletes. *Journal of Physical Activity and Sport, Society, Education and Heath*, *3*(2), 66–74. https://www.asjp.cerist.dz/en/article/128311

Haerens, L., Vereecken, C., Maes, L., &Bourdeaudhuij, I. D. (2010). Relationship of physical activity and dietary habits with body mass index in the transition from childhood to adolescence: A 4-year longitudinal study. *Public Health Nutrition*, *13*(10A), 1722–1728. https://doi.org/10.1017/S1368980010002284

Hallal, P. C., Victora, C. G., Azevedo, M. R., & Wells, J. C. (2006). Adolescent physical activity and health. *Sports Medicine*, *36*(12), 1019–1030.

Haskell, W. L., Blair, S. N., & Hill, J. O. (2009). Physical activity: Health outcomes and importance for public health policy. *Preventive Medicine*, *49*(4), 280–282.

Hill, J. (2004). Physical activity and obesity. *The Lancet*, *363*(9404), 182.

Huang, T. T.-K., Roberts, S. B., Howarth, N. C., & McCrory, M. A. (2005). Effect of Screening Out Implausible Energy Intake Reports on Relationships between Diet and BMI. *Obesity Research*, *13*(7), 1205–1217. https://doi.org/10.1038/oby.2005.143

Jakicic, J. M., Rogers, R. J., Davis, K. K., & Collins, K. A. (2018). Role of Physical Activity and Exercise in Treating Patients with Overweight and Obesity. *Clinical Chemistry*, *64*(1), 99–107. https://doi.org/10.1373/clinchem.2017.272443

Janssen, I., & LeBlanc, A. G. (2010). Systematic review of the health benefits of physical activity and fitness in school-aged children and youth. *International Journal of Behavioral Nutrition and Physical Activity*, *7*(1), 1–16.

Junger, J., Salonna, F., Bergier, J., Junger, A., Frömel, K., Ács, P., &Bergier, B. (2019). Physical Activity and Body-Mass-Index Relation in Secondary-School Students of the Visegrad Region. *Undefined*. /paper/Physical-Activity-and-Body-Mass-Index-Relation-in-Junger-Salonna/a72003373b277319a435e9a162beacf021c2886d

Kelishadi, R., Ardalan, G., Gheiratmand, R., Gouya, M. M., Razaghi, E. M., Delavari, A., Majdzadeh, R., Heshmat, R., Motaghian, M., &Barekati, H. (2007). Association of physical activity and dietary behaviours in relation to the body mass index in a national sample of Iranian children and adolescents: CASPIAN Study. *Bulletin of the World Health Organization*, *85*, 19–26.

Corresponding author: Guebli Abdelkader **E-mail:** abdelkader85@windowslive.com

Kelishadi, R., Ardalan, G., Gheiratmand, R., Gouya, M. M., Razaghi, E. M., Delavari, A., Majdzadeh, R., Heshmat, R., Motaghian, M., Barekati, H., Mahmoud-Arabi, M. S., &Riazi, M. M. (2007). Association of physical activity and dietary behaviours in relation to the body mass index in a national sample of Iranian children and adolescents: CASPIAN Study. *Bulletin of the World Health Organization*, *85*, 19–26. https://doi.org/10.1590/S0042-96862007000100008

Kim, B.-Y., Choi, D.-H., Jung, C.-H., Kang, S.-K., Mok, J.-O., & Kim, C.-H. (2017). Obesity and Physical Activity. *Journal of Obesity & Metabolic Syndrome*, *26*(1), 15–22. https://doi.org/10.7570/jomes.2017.26.1.15

Kruk, J. (2009). Physical activity and health. *Asian Pac J Cancer Prev*, *10*(5), 721–728.

La Guardia, J., & Ryan, R. (2002). What adolescents need. *Academic Motivation of Adolescents*, *2*, 193–218.

Lissner, L., &Heitmann, B. L. (1995). Dietary fat and obesity: Evidence from epidemiology. *European Journal of Clinical Nutrition*, *49*(2), 79–90.

Martin, A., Booth, J. N., Laird, Y., Sproule, J., Reilly, J. J., & Saunders, D. H. (2018). Physical activity, diet and other behavioural interventions for improving cognition and school achievement in children and adolescents with obesity or overweight. *Cochrane Database of Systematic Reviews*, *1*. https://doi.org/10.1002/14651858.CD009728.pub3

Moholdt Trine, Lavie Carl J., & Nauman Javaid. (2018). Sustained Physical Activity, Not Weight Loss, Associated With Improved Survival in Coronary Heart Disease. *Journal of the American College of Cardiology*, *71*(10), 1094–1101. https://doi.org/10.1016/j.jacc.2018.01.011

Mõttus, R., McNeill, G., Jia, X., Craig, L. C., Starr, J. M., & Deary, I. J. (2013). The associations between personality, diet and body mass index in older people. *Health Psychology*, *32*(4), 353.

Murphy, C., Takahashi, S., Bovaird, J., & Koehler, K. (2021). Relation of aerobic fitness, eating behavior and physical activity to body composition in college-age women: A path analysis. *Journal of American College Health*, *69*(1), 30–37. https://doi.org/10.1080/07448481.2019.1647210

Must, A., &Tybor, D. J. (2005). Physical activity and sedentary behavior: A review of longitudinal studies of weight and adiposity in youth. *International Journal of Obesity*, *29*(2), S84–S96.

Mustelin, L., Silventoinen, K., Pietiläinen, K., Rissanen, A., &Kaprio, J. (2009). Physical activity reduces the influence of genetic effects on BMI and waist circumference: A study in young adult twins. *International Journal of Obesity*, *33*(1), 29–36.

Newby, P. K. (2009). Plant foods and plant-based diets: Protective against childhood obesity? *The American Journal of Clinical Nutrition*, *89*(5), 1572S-1587S.

Corresponding author: Guebli Abdelkader **E-mail:** abdelkader85@windowslive.com

Nicklas, T. A., Myers, L., Reger, C., Beech, B., & Berenson, G. S. (1998). Impact of breakfast consumption on nutritional adequacy of the diets of young adults in Bogalusa, Louisiana: Ethnic and gender contrasts. *Journal of the American Dietetic Association*, *98*(12), 1432–1438.

O'Donovan, G., Blazevich, A. J., Boreham, C., Cooper, A. R., Crank, H., Ekelund, U., Fox, K. R., Gately, P., Giles-Corti, B., Gill, J. M. R., Hamer, M., McDermott, I., Murphy, M., Mutrie, N., Reilly, J. J., Saxton, J. M., & Stamatakis, E. (2010). The ABC of Physical Activity for Health: A consensus statement from the British Association of Sport and Exercise Sciences. *Journal of Sports Sciences*, *28*(6), 573–591. https://doi.org/10.1080/02640411003671212

Ogden, C. L., Flegal, K. M., Carroll, M. D., & Johnson, C. L. (2002). Prevalence and trends in overweight among US children and adolescents, 1999-2000. *JAMA*, *288*(14), 1728–1732. https://doi.org/10.1001/jama.288.14.1728

Ortega, F. B., Ruiz, J. R., Castillo, M. J., &Sjöström, M. (2008). Physical fitness in childhood and adolescence: A powerful marker of health. *International Journal of Obesity*, *32*(1), 1–11.

Paeratakul, S., Popkin, B. M., Keyou, G., Adair, L. S., & Stevens, J. (1998). Changes in diet and physical activity affect the body mass index of Chinese adults. *International Journal of Obesity*, *22*(5), 424–431.

PhD, R. R. S., PhD, R. P., PhD, A. C. U., & PhD, J. J. Z. (2002). Physical Activity Among Ethnically Diverse College Students. *Journal of American College Health*, *51*(2), 75–80. https://doi.org/10.1080/07448480209596333

Pietiläinen, K. H., Kaprio, J., Borg, P., Plasqui, G., Yki- Järvinen, H., Kujala, U. M., Rose, R. J., Westerterp, K. R., &Rissanen, A. (2008). Physical inactivity and obesity: A vicious circle. *Obesity*, *16*(2), 409–414.

R, L., Da, G., Je, F., H, W., L, K., &Jl, C. (2000). Physical activity, food choice, and weight management goals and practices among US college students. *American Journal of Preventive Medicine*, *18*(1). https://doi.org/10.1016/s0749-3797(99)00107-5

Rejeski, W. J., & Mihalko, S. L. (2001). Physical Activity and Quality of Life in Older Adults. *The Journals of Gerontology: Series A*, *56*(suppl_2), 23–35. https://doi.org/10.1093/gerona/56.suppl_2.23

Rudd, A., & Johnson, R. B. (2010). A call for more mixed methods in sport management research. *Sport Management Review*, *13*(1), 14–24. https://doi.org/10.1016/j.smr.2009.06.004

Sallis, J. F., Floyd, M. F., Rodríguez, D. A., &Saelens, B. E. (2012). Role of built environments in physical activity, obesity, and cardiovascular disease. *Circulation*, *125*(5), 729–737.

Corresponding author: Guebli Abdelkader **E-mail:** abdelkader85@windowslive.com

Savige, G., MacFarlane, A., Ball, K., Worsley, A., & Crawford, D. (2007). Snacking behaviours of adolescents and their association with skipping meals. *International Journal of Behavioral Nutrition and Physical Activity*, *4*(1), 1–9.

Sevim, Y. (2002). *Training science* (First edition.). Nobel Pub.

Söderlund, A., Fischer, A., & Johansson, T. (2009). Physical activity, diet and behaviour modification in the treatment of overweight and obese adults: A systematic review. *Perspectives in Public Health*, *129*(3), 132–142. https://doi.org/10.1177/1757913908094805

Ströhle, A. (2009). Physical activity, exercise, depression and anxiety disorders. *Journal of Neural Transmission*, *116*(6), 777–784.

Terry T.-K. Huang PhD, M., Kari Jo Harris PhD, M., PhD, R. E. L., Niaman Nazir MBBS, M., PhD, W. B., &Harsohena Kaur MD, M. (2003). Assessing Overweight, Obesity, Diet, and Physical Activity in College Students. *Journal of American College Health*, *52*(2), 83–86. https://doi.org/10.1080/07448480309595728

Tremblay, M. S., Gray, C. E., Akinroye, K., Harrington, D. M., Katzmarzyk, P. T., Lambert, E. V., Liukkonen, J., Maddison, R., Ocansey, R. T., &Onywera, V. O. (2014). Physical activity of children: A global matrix of grades comparing 15 countries. *Journal of Physical Activity and Health*, *11*(s1), S113–S125.

Tudor-Locke, C., Hart, T. L., & Washington, T. L. (2009). Expected values for pedometer-determined physical activity in older populations. *International Journal of Behavioral Nutrition and Physical Activity*, *6*(1), 1–6.

Tudor-Locke, C., McClain, J. J., Hart, T. L., Sisson, S. B., & Washington, T. L. (2009). Expected values for pedometer-determined physical activity in youth. *Research Quarterly for Exercise and Sport*, *80*(2), 164–174.

Umutlu, G., Acar, N. E., &Akkoyunlu, Y. (2018). Evaluation of Health-Related Physical Fitness Profiles of Turkish Students in Urban and Rural School Districts. *International Journal of Disabilities Sports and Health Sciences*, *1*(1), 29–37. https://doi.org/10.33438/ijdshs.432510

Volpe, S. L., Kobusingye, H., Bailur, S., & Stanek, E. (2008). Effect of diet and exercise on body composition, energy intake and leptin levels in overweight women and men. *Journal of the American College of Nutrition*, *27*(2), 195–208.

Yaman, C. (2009). The effects of the diet and diet+ exercise on changes in weight during adolescence. *Turkish Journal of Medical Sciences*, *39*(2), 273–279.

Corresponding author: Guebli Abdelkader **E-mail:** abdelkader85@windowslive.com