PATTERNS OF PHYSICAL ACTIVITY AMONG SAUDI CHILDREN, ADOLESCENTS, AND ADULTS WITH SPECIAL REFERENCE TO HEALTH

Hazzaa M. AL-Hazzaa, PhD, FACSM

Exercise Physiology laboratory, King Saud University, Riyadh, Saudi Arabia

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ABSTRACT

During the past two decades, Saudi Arabia has witnessed a tremendous development and urbanization at astounding rate. The standard of living rises and mechanization has been apparent in all aspects of people's life. And as industrialization and modernization progressed, substantial changes in physical activity patterns and eating habits are likely to have occurred. Indeed, physical inactivity and sedentary living with associated low level of physical fitness are increasingly becoming prevalent in the Saudi society. From the available published studies, it appears that most of Saudi children, adolescents, and more so adults do not meet the minimal weekly requirement of moderate to vigorous physical activity necessary for effectively functioning cardiorespiratory system. Evidences from daily heart rate telemetry indicate that the average Saudi boys spends less than 10 minutes a day in activities that promote cardiorespiratory fitness, and many children may never engage in any activity of moderate to high intensity level at all. Obese boys tend to be physically less active than lean boys. In addition, inactive children exhibit higher levels for most of coronary artery disease risk factors compared with active children. Moreover, the proportion of Saudi adults ages 18 years and older who are classified as regularly active varied from approximately 22% in young males (college students) to about 19% in adult males. These figures are considerably lower than what have been reported from many Western countries. Data on the patterns of physical activity of Saudi women are yet to be published. Furthermore, the most influencing factors on the levels of physical activity in Saudi children and adolescents appear to be obesity, cardiorespiratory fitness, TV viewing, and physical education program. As for Saudi adults, the most important reason for being physically active was to maintain health, while time constraint seems to be the major factor for not being active. Based on the available evidences, promotion of physical activity appears to be warranted. Finally, studies with nationally representative samples are urgently needed.

***Key words**: physical activity, Saudi Arabia, health indicators, heart rate telemetry, children & adolescents health.*

INTRODUCTION

For considerably long time, our ancestors had lived simple yet satisfying life. They appeared to have plenty of exercise by just doing their hard-working and physically demanding daily-work tasks. This enforced exercise prescription was apparently of sufficient duration and intensity to maintain lean body mass and appropriate levels of physical fitness.

During recent years, however, the kingdom of Saudi Arabia has witnessed a tremendous development at astounding rate. The standard of living rises and mechanization has been apparent in all aspects of people's life. And as industrialization and modernization progress, a number of changes in physical activity and eating patterns are likely to occur. Indeed, The changes in life style for the society at large have been very dramatic. Physical inactivity, hence, and sedentary living with associated low level of physical fitness are increasingly becoming prevalent in the Saudi society. More over, with satellite TV and increased reliance on computer and telecommunication technology, further reduction in physical activity is projected in the coming years.

The impact of these life style changes on societal health is very considerable. In fact, These changes were thought to be responsible for the epidemic of non-communicable diseases along with their complications (Alwan, 1993). National epidemiological surveys in Saudi Arabia indicate high prevalence of overweight and obesity among Saudi adult population (AL-Nuaim, 1997; AL-Nuaim et al ., 1996; Elhazmi & Warsy, 1997). Furthermore, The assessments of body fats in school children revealed that obesity is on the rise, along with other coronary artery disease (CAD) risk factors, among Saudi children and adolescents (AL-Hazzaa, 1997; AL-Hazzaa et al., 1994; Al-Hazzaa et al., 1994a; Al-Hazzaa et al., 1993).

It is now well recognized that physical inactivity and increased sedentary living habits represent a serious threat to the body, and that a regular physical activity habit reduces an individual's risk of both cardiovascular disease and all-cause mortality (Blair et al., 1989; Bouchard et al., 1990; Haskell, 1994; Oja, 1995; Shephard, 1999; Shephard, 1997).

Recently, a number of consensus statements and governmental documents, including the US Surgeon General Report, have further emphasized the importance of regular physical activity to the heath and well being of people at all ages (ACSM, 1995, 1988; Fletcher et al., 1995; Leon, 1997; Pate et al., 1995; Pollock et al., 1998; Sallis & Patrick, 1994; US Department of Health, 1999,1996).

This paper, therefore, examines the status and patterns of physical activity among Saudi children, adolescents, and adults, and describes the health implications of physical inactivity on children and adolescents where data are most available. Additionally, it is the intent of this paper to briefly discuss the determinants of physical activity and factors influencing it in Saudi society.

PATTERNS OF PHYSICAL ACTIVITY AMONG SAUDI PEOPLE

It is important that we understand the definition of physical activity before examining its pattern among Saudi people. Physical activity is defined as any bodily movement produced by skeletal muscles that results in energy expenditure above the basal level (Caspersen et al., 1985; US Department of Health, 1996). Physical activity is considered a complex set of behaviors. Our ability to relate physical activity to health indicators depends on accurate, precise and dependable measures. Physical activity is commonly measured by either self-report or direct monitoring through mechanical/electronic or physiological measurements.

The published data regarding physical activity levels and patterns of Saudi people were mainly coming from two major sources of data collection; self-reported questionnaires and continuos monitoring of heart rate daylong. Heart rate (HR) telemetry was exclusively applied for studies involving children and adolescents. However, before discussing these physical activity data, three important notes must be mentioned. First, nationally representative population studies describing the patterns of physical activity and energy expenditure in the Saudi society are relatively nonexistent. Second, all the published studies that are presented in this paper, whether coming from our laboratory at king Saud University or from a doctoral thesis by Alshehri (1998), had samples were

drawn from Riyadh, the capital of Saudi Arabia, with a population of over three million inhabitants. Nevertheless, since the changes in life style and eating habits for the Saudi people have occurred across the country and was not limited to the capital, there is no real reason not to generalize our results on other Saudi people living in urbanized areas of Saudi Arabia (according to the 1992 national population census over 60% of the Saudi population live in urbanized areas). Third., there exist no published data, at all, on physical activity patterns of Saudi females.

Physical Activity Patterns of Children and Adolescents

It is widely recognized that children and youth need regular physical activity for normal growth and development, and maintenance of good health and fitness (Al-Hazzaa, 1997; ACSM, 1988; Sallis & Patrick, 1994; Pate & Trost, 1998; US Department of Health, 1996). Table 1 presents two major consensus statements concerning physical activity recommendations for children and adolescents. The first one was from the International Consensus Conference on Physical Activity Guidelines for Adolescents, published in 1994 (Sallis & Patrick, 1994), and the second statement was the results of NIH Consensus Conference held in 1995(NIH, 1996). Both statements call for regularly sustained physical activity of moderate to vigorous intensity in most days of the week. The question we, then, can ask is that do Saudi children and adolescents satisfy these requirements of almost daily physical activity?

In the early 90's, we started a series of research studies aimed to assess the pattern of physical activity among Saudi children and adolescents, with special reference to cardiovascular health and fitness (Al-Hazzaa, 1995; Al-Hazzaa, 1995a; Al-Hazzaa, 1994; Al-Hazzaa & Sulaiman, 1993; Al-Hazzaa et al., 1994; Al-Hazzaa, 1994a; Al-Hazzaa et al., 1993). For physical activity assessment we used all-day heart rate telemetry measurement, as seen in figure1. The data was stored and then retrieved at a later time. Figure 2 presents minute by minute heart rate tracing of one boys for 12 hours during a weekday.

The results of heart rate telemetry of Saudi boys are summarized in figure 3. As it is shown in the figure, The boys spent limited time on activities that raise the heart rate

above a level corresponding to ventilatory anaerobic threshold (HR-VAT), and even less time on activities that raise the heart rate to or above 160 bpm, which is equivalent to 60% of a child's maximal heart rate reserve. Out of 8 hours of continuous monitoring, the boys spent an average of 14.6 and 9.1 minutes on activities that raise the heart rate above HR-VAT or above 159 bpm, respectively. In fact, about 16% of the children never exceeded a heart rate of 159 bpm during the whole day period. Analysis of the physical activity patterns according to age showed no significant differences in mean physical activity levels between boys of different ages (7-12 years), though children at age 11-12 years tend to have more time spent at vigorous activity compared to the other age categories. In contrast to the above mentioned findings of low daily activity profile for the average Saudi boys, trained young soccer players, between the age of 11&15 years, were able to spend 63.7% of a soccer match with heart rate above 159 bpm(AL-Hazzaa et al., 1995). This amounts to 38.2 minutes in a 60-min soccer match.

In another study, which was based on self- reported questionnaire sent to a sample of 220 young Saudi boys, 24% of the sample reported that they were being active in sports for 5 hours or more weekly, while 28% of the boys were physically active for less than two hours a week (AL-Hazzaa, 1995). Self-reported activities by the children/or their parents, however, are not as valid and reliable as heart rate monitoring when assessing physical activity levels. As for the activity most commonly reported by the Saudi boys (as shown in table 2), soccer was ranked first followed by swimming, bicycling, and walking/jogging (AL-Hazzaa, 1995). The later three sports are considered lifelong physical activities.

There is a dearth of information regarding physical activity patterns of young Saudi girls. However, in a doctoral thesis, aimed on assessing coronary artery disease (CAD) risk factors among Saudi school children (Alshehri, 1988), hypoactivity, hpyercholesterolaemia, and obesity were found to be the main prevalent risk factors among children. Girls were shown to have 17% lower physical activity score than boys.

Although very little information is available on physical activity patterns among special populations in Saudi Arabia, one very recent study did monitor daily heart rates for 12 hours continuously in a group of mentally-retarded children including those with Down syndrome (AL-Harby et al, 1999). Table 3 presents the results of such a study. Mean daily heart rate was significantly lower in mentally-retarded boys compared with healthy controls. In addition, the percentage of time spent on activities raising the heart rate to 40% of heart rate reserve or above was significantly higher in the healthy normal subjects. There is also a trend that the percentage of time spent on activities raising the heart rate above 50% of individual's resting heart rate was higher among the control group.

To summarize the patterns of physical activity among Saudi children and adolescents, we can say that from the available evidences it seems that most Saudi children and adolescents (and more so for girls) do not meet the minimal weekly requirement of moderate to vigorous physical activity necessary for an effectively functioning cardiorespiratory system. These findings become really alarming when considering the fact that nearly 50% of Saudi population are under 15 years of age (or 6 millions children according to the national population census held in 1992).

Physical Activity Patterns of Saudi Adults

When scanning the published literature on physical activity of Saudi adults, one can really be surprised how little research has been done in this important area of study. Only two major study were located that deals with the patterns of physical activity of Saudi adults. Both deal with males, and written in Arabic. Table 4 presents the findings of these two studies. Physical inactivity varied somewhat among the two reports, averaging from about 46% in college males (AL-Hazzaa, 1990) to over 53% in adult males (AL-Refaee & AL-Hazzaa, 1997). The proportion of Saudi adults ages 18 years and older who are classified as physically active in a regular bases also varied from about 22% in college males to about 19% in adult males. Despite minor differences, these two reports were consistent. In the college-male study (Al-Hazzaa, 1990), when the proportion of subjects who met or exceeded a frequency of 3 times a week was considered, the percentage of young adults who were active dropped from 22% to 15%. With this considerably low rate of activity

level, especially in young adults, it comes in no surprise that the percent of young adults who utilize sports clubs facilities was shown to be very low. In a research survey, conducted about 15 years ago on a sample of young adults from the GCC countries (Educational Research Center, 1986), responses from Saudi sample indicated that only 7.1% of young males in this country uses the services or/and involved in sport activities offered by youth institutions.

To draw a brief comparative picture on physical activity profile of people from other countries, the following is sufficed. The US Surgeon General Report (US Department of health, 1996) indicated that according to three recent surveys the proportion of inactive adults in the USA varied from 21.7% to 28.7%. Healthy people 2000 Objectives of the USA calls for reducing to no more than 15% the proportion of people aged 6 year and older who are inactive (US Department of Health, 1999). In a review paper, Oja (1995) presented the health- related physical activity profiles from several European and North American countries. The proportion of moderately and/or vigorously active males in this review varied from 21%in Sweden to nearly 50% in Canada and England.

As to the physical activity most commonly reported by Saudi males, table 5 presents findings from two studies (AL-Hazzaa, 1990; AL-Hazzaa,1995). The second study (AL-Hazzaa, 1995) was primarily focusing on children, but included some questions for parents (adults). Nevertheless, both studies were consistent in that walking and/or jogging ranked number one activity for young and middle age adults. It is obvious also that lifelong activities account for the most of leisure time physical activities of Saudi adults.

Studies on physical activity patterns of Saudi women are, unfortunately, yet to be published. This is happening in spite of the fact that obesity, for example, is more prevalent in Saudi females than in males (AL-Nuaim et al., 1996; EL-Hazmi & Warsy, 1997). However, casual observation suggests that women, in general, are less active than men. This trend is supported by findings from Western societies that women are less active than men (US Department of Health, 1996), though the opportunities for women to be active are much greater than in the Middle-Eastern culture.

Associations Between Physical Activity and Health Indicators

Regular physical activity has long been regarded as an important part of a healthy lifestyle. And recent evidences have strongly reconfirmed this relationship between physical activity and a wide range of physical and mental health benefits (ACSM, 1988, 1995; Bouchard et al., 1990; Leon, 1997; NIH, 1996; Pollock et al., 1998; Sallis & Patrick, 1994; US Department of Health, 1996). Physical inactivity and sedentary living habits, on the other hand, have been linked to a number of chronic diseases, including CAD, hypertension, diabetes mellitus, osteoporosis, colon cancer, and anxiety and depression (Bouchard et al., 1990; Leon, 1997; NIH, 1996; Pate et al., 1995; US Department of Health, 1996).

Studies relating physical activity (or inactivity) to health indicators in Saudi adults are undoubtedly lacking. However, data concerning physical activity patterns of Saudi children and adolescents, relative to cardiovascular health and fitness, do exist (AL-Hazzaa, 1997; AL-Hazzaa, 1995; AL-Hazzaa, 1995a; AL-Hazzaa, 1994; AL-Hazzaa & Sulaiman, 1993; AL-Hazzaa et al., 1994; AL-Hazzaa et al, 1994a; AL-Hazzaa et al., 1993). The interests in studying children physical activity relative to cardiovascular health stem from the fact that diseases such as CHD and obesity, for which inactivity is a likely risk factor, have their origin in childhood (Sallis et al, 1992). Indeed, a number of CAD risk factors were shown to exist in Saudi children 7-13 years of age (AL-Hazzaa et al., 1993). In the above mentioned study, it was found that out of 220 Saudi boys who were studied 22.9% exceeded total cholesterol level of 5.2 mmol/l; 26.4% had triglycerides level above 1.4 mmol/l; 15.4% had LDL-C level above 3.4 mmol/l; 4% had HDL-C level below 0.96 mmol/l; about 16% were obese (fat % was above 25% of body mass); and 4.2% had high systolic and diastolic blood pressures. Another important consideration in studying physical activity of children is that physical activity habits are established early in life and they have to some extent an influence on adult physical activity (Taylor et al., 1999).

In one of our studies (AL-Hazzaa, 1997) coronary artery disease (CAD) risk factors were more present in the least active boys compared to the most active counter parts, as seen in

table 6. With the exception of total serum cholesterol mean values for all other CAD risk factors are much higher in the least active boys compared to the most active group. Physical activity, in this respect, was assessed by the percentage of time that boys spent in activity raises the heart rate to above 159 bpm (60% of maximal heart rate reserve). When the percentages of children who exceeded certain recommended levels of blood lipids were considered relative to activity levels, as seen in table 7, There was a clear reduction in risk with increased activity level (AL-Hazzaa et al., 1994).

Factors Influencing Physical Activity of Saudi People

Accumulating evidences indicate that physical activity is influenced by several factors. Although there are some differences between children and adults determinants of physical activity, they can be broadly classified into demographic, physiological, psychological, and environmental factors (king et al., 1992; Taylor et al., 1999; US Department of Health, 1999). In the next paragraphs, the most pertinent factors that influence physical activity of Saudi children and adults, and of which we have some research data, will be examined.

Obesity

Cross-sectional studies (AL-Hazzaa et al., 1994; AL-Hazzaa et al., 1994a; AL-Hazzaa et al, 1993) indicate that about 16% of Saudi school boys are considered obese (body fat content is above 25% of body mass). What is more, is the fact that mean fat percent seems to have increased considerably over the past decade (AL-Hazzaa, 1997). Moreover, longitudinal analysis of data for a small group of Saudi boys living in Riyadh showed that body fat percent had increased from 15% at the age of 8.0 years to about 21% at 13 years of age (AL-Hazzaa et al., 1997). Research on CAD risk factors in Saudi children (AL-Hazzaa et al., 1993) showed that obesity correlated positively with triglycerides level ($r = 0.28$; $p<.01$) and HDL-C/TC ration ($r = 0.22$; $p<.01$).

Furthermore, obesity has long been considered as a negative determinant of physical activity behavior (US Department of Health, 1996). In Saudi children and adolescents, obesity had a low correlation with physical activity, but a higher correlation with cardiovascular fitness. This fairly low correlation between obesity and physical activity

can be explained by two reasons. First is that large proportion of obese children who are inactive will not have any time spent above heart rate of 159 bpm, and therefore is excluded from the analysis. Second, There are many confounding factors that can influence the relationship between obesity and physical activity. Despite the above-mentioned statements, when physical activity levels of obese versus lean subjects were examined (Table 8), we can see that lean boys were more active than obese boys (AL-Hazzaa et al., 1993a). The differences between the two groups were evident in both vigorous as well as moderate-activity levels, ranging from about 50% at intensity above 159 bpm to about 30% at intensity above139 bpm.

Cardiorespiratory Fitness

Data on cardiorespiratory fitness, as measured by maximal oxygen uptake (VO2 max) in the laboratory, indicate that untrained Saudi boys between the age of 7 and 15 years have on the average about 48 ml/kg. min (AL-Hazzaa & Sulaiman, 1993; AL-Hazzaa, 1997). This value increases to about 56 ml/kg.min in a group of trained young soccer players (AL-Hazzaa et al., 1995). The relationship between cardiorespiratory fitness and physical activity was shown to be significant in a group of Saudi children, with a correlation coefficient of 0.29 (AL-Hazzaa & Sulaiman, 1993). As seen in table 9, physically fit boys tend to be physically active compared to less fit counterparts. Furthermore, physically active Saudi boys tend to run 1000 meters faster than less active boys (AL-Hazzaa et al., 1994a).

School Physical Education Program

School physical education (PE) program is viewed as an important factor in establishing a life long physical activity habits for young people (US Department of Health, 1996, 1999). Unfortunately, school (PE) program in Saudi Arabia suffers from major deficiency in both the quantity of weekly allocated PE time as well as the quality of the offered program. In the primary schools, students get two-45 minutes of PE weekly. While in the secondary and intermediate levels, it is only one-45 minutes of PE a week. Studies have demonstrated that the actual time for PE lesson was not more than 32 minutes (AL-Hazzaa, 1992; AL-Hazzaa, 1995a; AL-Hazzaa & Almuzaini, 1999). School's PE program

emphasized the traditional competitive sports such as soccer and track & field, at the expenses of lifetime fitness activities, weight training, and recreational and outdoor pursuits. Females, however, do not have PE at all.

Studies that monitor heart rate during PE lessons in Saudi schools have given us valuable information on the intensity of these PE lessons (as shown in table 10). The percentage of time student were engaged in moderately intense activity (above 60% of individual's maximal heart rate reserve) varied from about 30% at the primary school (AL-Hazzaa, 1992; AL-Hazzaa, 1995a) to 39% at the intermediate schools (AL-Hazzaa & Almuzaini, 1999). These figures translate to about 13 minutes, at most, of activity that is high enough to promote cardiorespiratory fitness.

Correlational analyses of children activity levels during PE lessons with their activity levels outside school reveals a significantly moderate correlation coefficient ($r = 0.48$; $p<0.05$) (AL-Hazzaa, 1995a; Al-Hazzaa & Sulaiman, 1993). This means that students who were active in PE lesson were likely to be active outside school time, too, and vice versa. This finding have some implications to how PE teachers conduct their classes. They should, therefore, give a great attention and care to those inactive students in PE lessons.

Other Determinants of Physical Activity in Saudi People:

Physical activity is influenced by both genetic and environmental factors (Perusse et al., 1989). It is estimated that the genetic effects of habitual physical activity to be at 20% of the total variation (Perusse et al., 1989). In one of our studies on 40 pairs of Saudi prepubescent brothers (AL-Hazzaa, 1994). We found a heritability coefficient of 0.52 ($P<0.01$) in the percentage of time spent at heart rate above 159 bpm. However, the heritability coefficient was much lower when physical activity of moderate intensity was considered.

Television viewing is another environmental factor that influences physical activity. In Saudi children, television watching showed an inverse relationship with the amount of time spent in physical activity (AL-Hazzaa, 1995). Television viewing was shown, else where, to be a strong predictor of obesity in children and adolescents (Dietz, 1985).

Normative beliefs of parent regarding physical activity of their children were also shown to be predictors of physical activity behavior in children and adolescents (Sallis et al., 1992). In one of our studies (AL-Hazzaa, 1995), the correlation between children's physical activity and how parents valued the importance of physical activity for their children was shown to be significant ($r = 0.29$; $p = 0.0001$). Also the activity level of the parents could influence their children's physical activity. Saudi parent-child physical activity correlation coefficient was found to be 0.20($p = 0.002$).

Tables 11&12 present the most important reasons for Saudi adults to be active or inactive, respectively, according to two different studies with samples from Riyadh (AL-Hazzaa, 1990; AL-Refaee & AL-Hazzaa, 1997). Maintaining health (including loosing weight) was number one reason for both young and middle-aged Saudi adults. Recreation and socializing came second and third, respectively. The major barriers to physical activity of Saudi adults are shown in table 12. Time constraint seems to be the major factor for not being physically active. In one of the physical activity studies (Al-Refaee & AL-Hazzaa, 1997), physical activity level was lower for those who were married, working in private sector, working two shifts, or who had only one day off during the week.

Promoting Physical Activity in Saudi Arabia

Obviously getting people to change their life style in relation to exercise habits requires a tremendous effort from those involve in governmental policy, community health, school education, municipalities, etc. However, the following suggestions for promoting physical activity may be implicated:

1- National policy initiatives are needed for promoting physical activity. The Saudi Sports Medicine Association, the Saudi Physical Education Federation, and the Saudi Federation for Sports For All should play a leading role in developing such initiatives for the promotion of physical activity among Saudi children, youth, & adults.

2- Implementation of physical education curricula and instruction that emphasize daily PE lessons with enjoyable participation in lifelong physical activities.

3- Providing physical education instruction and extracurricular activities that meet the needs and interest of all students, including the disabled, the obese, the low fit, and those with chronic health problems.

4- Parents and health care providers should advocate for quality physical activity instruction in schools.

5- Provision for more physical activity facilities and programs, as well as making school sports facilities available for community after school hours and in the weekend.

6- Medical communities and associations must involve in a public education effort aimed on encouraging active life style and healthy eating habits among Saudi people.

7- Primary care providers have an important role to play in physical activity promotions, by providing routine assessment and counseling on physical activity and fitness for their patients.

8- Active approaches requiring individual's initiative (such as enrolling in exercise program), though are partially successful in promoting physical activity, are not enough. Passive approaches should be incorporated, too. Such strategies include providing walking trails, time allowance for exercise at work, & have school facilities opened for community use after school hours.

9- Opportunities for physical activity should be made available for a wide range of people including elderly, children, and women. For municipalities, this means establishing safe and convenient walking, jogging, and bicycling paths, and playgrounds and fitness areas for children and adults. For schools, this may include having the community uses facilities on weekend. School could also hold a health, fitness and physical activity fair and invite parents as well. Summer camps for obese or disables children and adolescents should be fully considered, where they can learn about fitness and physical activity.

10- Business organizations can support healthy life style by establishing fitness and wellness programs and providing exercise facilities with trained leaders in physical activity, fitness and health promotion.

11- Innovative ideas for planning fitness facilities should be fully explored. This may include such places as shopping malls.

12- Colleges and universities should consider establishing programs in exercise sciences and fitness, which can provide trained graduates in such areas as fitness, wellness, and physical activity promotion.

References

AL-Harby, M., H. AL-Hazzaa, and A. Hassan (1999). Physical activity patterns of mentally retarded Saudi children. Proceedings the Symposium on "Research for the Betterment of the Disabled", Riyadh, Saudi Arabia.

AL-Hazzaa, H.(1997). Pediatric Exercise Physiology. Saudi Sports Medicine Association, Riyadh. pp. 285-311, 387- 414.

AL-Hazzaa, H. (1995). Physical activity level of Saudi children (in Arabic). King Saud university J., 7(1), 1-16.

AL-Hazzaa, H. (1995a). Cardiorespiratory load during physical education class: Results of heart rate telemetry in primary school (in Arabic) .Education Research Center, King Saud University, Saudi Arabia.

AL-Hazzaa, H. (1994). Familial effects on physiological variables in preadolescent boys. Proceedings of XXV FIMS Congress of Sport Medicine, Athens, Greece, P.16.

AL-Hazzaa, H. (1992). Heart rate telemetry of school children during physical activity lessons. In K.M. Chan (Ed.). Sports, Medicine and Health. Hong Kong, pp.23-26.

AL-Hazzaa, H. (1990). Physical activity patterns of Saudi college males (in Arabic). King Saud University J., 2, 383-396.

AL-Hazzaa, H., and K. Almuzaini (1999). Heart rate telemetry during physical education classes in Riyadh's intermediate schools (in Arabic). King Saud University J.11(1): 1-15.

AL-Hazzaa, H., and M. Sulaiman (1993). Maximal oxygen uptake and daily physical activity in 7-to-12 year old boys. Pediatr. Exerc. Sci., 5, 357-366.

AL-Hazzaa, H., S. AL-Refaee, M. Sulaiman, and M. Dafterdar (1997). Development of maximal aerobic power and pulmonary ventilation in Saudi boys. Proceedings the 2nd Annual Congress of the European College of Sport Science. Copenhagen, Denmark, pp. 454-455.

AL-Hazzaa, H., M. Sulaiman, K. AL-Mobaireek, and O. AL-Attass (1993). Prevalence of coronary artery disease risk factors in Saudi children. J. Saudi Heart Association, 5:126-133.

AL-Hazzaa, H., M. Sulaiman, A. Matar, and K. AL-Mobaireek (1993a). Maximal aerobic power, physical activity level, & CAD risk factors in lean versus obese children. Proceeding of the Joint Meeting of PWP & NASPEM, Aliston, Ont., Canada.

AL-Hazzaa, H., M. Sulaiman, A. Matar, and K. AL-Mobaireek (1994). Cardiorespiratory fitness, physical activity patterns, & selected coronary artery disease risk factors in preadolescent boys. Int. J. Sports Med., 15:267-272.

AL-Hazzaa, H., M. Sulaiman, A. Matar, and K. AL-Mobaireek (1994a). Physical fitness, and physical activity in relation to skeletal growth and muscular development of Saudi children. (in Arabic). Educational Research Center, King Saud University, Riyadh, Saudi Arabia.

AL-Hazzaa, H., K. Almuzaini, S. AL-Refaee, M. Sulaiman, et al. (1995). Energy demands and fluid loss during youth soccer. In: N. O'Hata (Ed.).Science and Football. Asian Football Confederation, Tokyo, pp. 310-325.

Al-Nuaim, A. (1997). Population-based epidemiological study of the prevalence of overweight and obesity in Saudi Arabia, regional variation. Ann Saudi Med. 17, 195 199.

Al-Nuaim, A, K. AL-Rubeaan, Y. AL-Mazrou, O. ALAttas, N. AL-Daghari and T. khoja (1996). High prevalence of over weight and obesity in Saudi Arabia. Int J Obesity, 20, 547-552.

AL-Refaee, S., and H. AL-Hazzaa (1997). Physical activity patterns of Saudi males living in Riyadh city. Proceedings of 1st Scientific Symposium of P.E Departments in GCC Countries, King Saud University, Riyadh, pp. 24-25.

Alshehri, S. (1998). Nutritional variation and coronary risk factors among Saudi school children. Doctoral thesis, University of London.

Alwan, A. (1993). Diseases of modern lifestyles: the need for action. Health Services Journal of the Eastern Mediterranean, WHO, 7, 24-34.

American College of Sports Medicine (1995).ACSM'S Guidelines for Exercise Testing and Prescription. Williams & Wilkins, Baltimore. Chapters, 1,2, 7, 11.

American College of Sports Medicine (1988). Opinion statement on physical fitness in children and youth. Med. Sci Sports Exerc. , 20,422-423.

Blair, S., H. Kohl, R. Paffenbarger, D. Clark , K. Cooper, and L.Gibbons (1989). Physical fitness and all-cause mortality: a prospective study of healthy men and women. J. Amer. Med. Assoc., 262 (suppl.17), 2395-2401.

Bouchard, C., R. Shephard, T. Stephens, J. Sutton, and B. McPherson (Eds.) (1990). Exercise, Fitness and Health. Human Kinetics, Champaign. IL.

Caspersen, C., K. Powell, and G. Christensen (1985). Physical activity, exercise, and physical fitness: definition and distinctions for health-related research. Public Health Reports, 100, 126-131.

Dietz, W., and S. Gortmaker (1985). Do we fatten our children at the television set? Obesity and television viewing in children and adolescents. Pediatrics, 75: 807-812.

Educational Research Center (1986). Young People's Utilization of Sports and Recreational Facilities in GCC Countries, (in Arabic) Research Center. College of Education, KSU, Riyadh (Abstract).

EL-Hazmi, M., and A. Warsy (1997). Prevalence of obesity in the Saudi population. Ann. Saudi Med. 17,302-306.

Fletcher, G., G. Balady, V. Froelicher, H. Hartely, W. Haskell, and M. Pollock (1995). Exercise Standards: A statement for health care professionals from the American Heart Association. Circulation, 91, 580-615.

Haskell, W. (1994). Health consequences of physical activity: understanding and challenges regarding dose-response. Med. Sci. Sports Exerc., 26, 649-660.

King, A., S. Blair, D. Bild, R. Dishman, et al. (1992). Determinats of physical activity and interventions in adults. Med. Sci Sports Exer., 24: S 221-S236.

Leon, A. (Ed.) (1997). Physical Activity and Cardiovascular Health- A National Consensus. Human kinetics, Champaign, IL., Chapters, I-IV, VI.

National Institutes of Health (1996). Physical Activity and Cardiovascular health, NIH Consensus Development Panel on Physical Activity and Cardiovascular Health J. Amer Med. Associ, 276(3), 241-246.

Oja, P. (1995). Descriptive epidemiology of health-related physical activity and fitness. Res. Quart. Exerc. Sport, 66, 303-312.

Pate, R., and S. Trost (1998). How to create a physically active future for American kids. ACS M'S Health and Fitness J., 2(6), 18-23.

Pate, R., M. Pratt, S. Blair, W. Haskell, et al. (1995). Physical activity and public health- a recommendation from the Centers for Disease Control and Prevention and the American College of Sports Medicine. J. Amer Med. Assoc., 273(5): 402-407.

Perusse, L., A. Tremblay, C. Leblance, and C. Bouchard(1989). Genetic and environmental influences on Level of habitual physical activity and exercise participation. Am. J. Epidemiol., 129, 1012-1022.

Pollock, M., G. Gaesser, J. Butcher, et al. (1998). The recommended quantity and quality of exercise fo r developing and maintaining cardiorespiratory and muscular fitness and flexibility in healthy adults. Med. Sci. Sports Exerc., 30, 975-991.

Sallis, J., and K. Patrick (1994). Physical activity guidelines for adolescents: Consensus Statement. Pediatr. Exerc. Sci, 6, 302-314.

Sallis, J., B. Simohs-Morton, E. Stone, C. Corbin, et al. (1992). Determinants of physical activity and interventions in youth. Med. Sci. Sports Exerc. , 24:S248-S257.

Shephard, R.(1999). How much physical activity is needed for good health? Int. J. Sports Med., 20,23-27.

Shephard, R. (1997). What is the optimal type of physical activity to enhance health? Br. J. Sports Med., 31, 277-284.

Taylor, W., S. Blair, S. Cummings, C. Wun, and R. Malina (1999). Childhood and adolescent physical activity patterns and adult physical activity. Med Sci Sports Exerc., 31, 118-123.

U.S Department of health and Human Services, Public health Service, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and health Promotion, Division of Nutrition and Physical Activity (1999). Promoting Physical Activity: A Guide for community Action. Human Kinetics, Champaign, IL.

U.S Department of health and Human Services, Centers for Disease control and prevention, National Center for Chronic Disease Prevention and Health Promotion (1996). Physical Activity and Health: A Report of the Surgeon General. CDC, Atlanta, GA.

Table 1. Major consensus statements on physical activity recommendation for children and adolescents.

International Consensus Conference on physical Activity Guidelines for Adolescents (Sallis & Patrick, 1994, PP.307, 308).

Guideline 1: " All adolescents should be physically active daily, or nearly every day, as part of play, games, sports, work, transportation, recreation, physical education, or planned exercise, in the context of family, school, and community activities."

Guideline 2: " Adolescents should engage in three or more sessions per week of activities that last 20 min or more at a time and that require moderate to vigorous level of exertion."

National Institute of Health Consensus Conference (NIH, 1996, P.241). "Children and adults alike should set a goal of accumulating at least 30 minutes of moderate-intensity physical activity on most, and preferably all, days of the week."

Table 2. Physical activity most commonly reported by Saudi children and adolescents.

Activity	Rank	Percentage (%)
Soccer	1	76.2
Swimming	2	32.0
Bicycling	3	30.7
Walking/Jogging	4	17.0
Free play	5	12.4
Self-defense	6	6.3

Data from Al-Hazzaa (1995)

Table 3. Physical activity levels of mentally-retarded Saudi children relative to healthy controls.

Variable	Mentally-retarded		Normal
	Down syndrome	Non-Down	
Age(yr.)	11.1 ±1.1	11.3±.97	11.0±1.0
Heart rate max (bpm)	172.7±3.2	192.9±6.4	196.5±3.8
Mean daily HR(bpm)	97.3±9.9	99.3±8.9	107.3±7.2 ¶
Time HR>40% HRR(%)	2.5±2.7	1.47±1.4	3.6±2.2 *
Time HR>50%HR rest (%)	32.8±18.7	29.4±19.8	41.7±19.1

HR= heart rate measured by heart rate telemetry; HRR= heart rate reserved;

HR rest = resting heart rate.

* different form non-Down (P<.05)

¶ different form non-Down & Down syndrom (P<.05)

Data from AL-Harby et al, 1999.

Table 4. Physical activity profile of Saudi males, drawn from two distinctive adult studies in Riyadh*.

Variable	Study 1	Study 2
Reference	Al-Hazzaa, 1990	Al-Refaee & Al-Hazzaa, 1997
Original sample	362	1333
Characteristics	College males (mean age = 22yr)	Adult (mean age = 41yr)
Physically Inactive	45.8%	53.4%
Physically Active		
Irregular	32.3%	27.7%
Regular	21.9%	18.8%

* Both studies used stratified random samples.

Table 5. Physical activity most commonly reported by Saudi adults, based on two different studies.

College Males (AL-Hazzaa, 1990)	Adult Males (AL-Hazzaa, 1995)
Walking/Jogging (32.2%)	Walking/Jogging (79%)
Soccer (27.7%)	Swimming (31.9%)
Swimming (8.2%)	Ball Games (26.7%)
Weight Training (5.7)	Racket Sports (22.9%)
Racket Sports (5.6%)	

* Percentages were inclusive (subjects reported all sports they participated in), while in the other study (AL-Hazzaa, 1990), subjects reported the most activity that they take part in.

Table 6. Coronary artery disease (CAD) risk factors by activity level in Saudi children (n = 92).* *

Risk Factor	Most Active (9.7 yr.)	Least Active (9.6 yr.)
Total cholesterol (mg/dl)	180	176
Triglycerides (mg/dl)	99.8	122.5 *
HDL-Cholesterol (mg/dl)	54.8	47.7 *
HDL-C/TC (%)	31.2	27.8 *
SBP (mm/Hg)	98.6	101.6
DBP (mm/Hg)	58.1	60.6

TC = Total cholesterol, SBP& DBP = Systolic and diastolic blood pressure.

* Significant differences at $P<0.05$

* * Subjects were matched for body mass and fat %.

Data from AL-Hazzaa, 1997

Table 7. The percentages of children who exceeded recommended levels of blood lipids based on physical activity levels.

	Activity level	
Risk Factor	Most Active	Least Active
TC (≥ 5.2 mmol/L)	22.7%	26.0%
TG (≥ 1.4 mmol/L)	9.1%	48.0%
HDL-C (≤ 0.96 mmol/L)	0.0%	4.3%
LDL-C (≥1.4 mmol/L)	8.7%	21.7%

Data from Al-Hazzaa et al., 1994.

Table 8. Physical activity levels in obese versus lean Saudi boys (means ± SEM).

Variable	Lean (N=52)	Obese (N=52)
Age (yr.)	9.2 ±.19	10.0 ± .19
Body mass(kg)	24.6 ± .60	42.3 ± 1.5
Body fat(%)	9.7 ± .13	29. ± 1.1
(%) of Time spent at activity raises HR:		
Above 159 bpm	2.30 ±.33	1.56 ± .24
Above 139 bpm	7.13 ± .90	5.5 ± .57

* Significant difference at 0.05 level
Data from Al-Hazzaa et al., 1993a.

Table 9 . Physical activity levels (based on HR telemetry) of Saudi children by cardiorespiratory fitness (VO2max)

VO2 max	% of Daily Time	
(ml/kg. min)	HR > 159 bpm	HR > 139 bpm
53.6	2.6 (.66)	7.6 (1.38)
43.5	1.29 (.33)	3.9 (.73)

Data of % of daily time were means (SEM).
Data from AL-Hazzaa & Sulaiman,1993

Table 10. Results of heart rate telemetry of school children and adolescents during physical education lessons.

Variable	Study 1	Study 2	Study 3
School level	**Primary**	**Primary**	**Intermediate**
Subject Age(yr)	**9.9 ±1.3**	**10.4± .96**	**14.4 ± 1.7**
Body fat %	**14.6 ±5.8**	**19.5 ± 10.4**	**17.9 ± 8.9**
Distance covered during P.E (km)	**1.93 ±.17**	**1.76 ± . 93**	**1.81 ± 1.2**
Time HR>159 bpm (%)	**28.4**	**32.6 ±2.4**	**39.4 ± 19.4**
Time HR>159 bpm (min)	**11.4**	**13.0**	**12.6**

Study 1 = AL-Hazzaa, 1992.
Study 2 = AL-Hazzaa, 1995a.
Study 3 = AL-Hazzaa & Almuzaini, 1999.

Table 11. Most important reasons for being physically active among Saudi males (results were from two adult studies in Riyadh).

Variable	Study 1 (College males)	Study 2 (Adults)
Reference	**Al-Hazzaa,1990**	**Al-Refaee & Al-Hazzaa,1997**
Age (yr.)	**21.9 ± 2.1**	**41.5 ± 10.2**
Reason (%)		
Maintaining health	**50.6%**	**42.9 %**
Loosing weight	*****	**21.0%**
Recreation	**35.5%**	**18.6 %**
Socializing	**7.3%**	**5.9%**
Medical Advice	**____**	**5.9%**
Miscellaneous	**6.6 %**	**5.9%**

* Included with maintaining health in this study

Table 12. Most important reasons for being physically inactive among Saudi males (results from two adult studies in Riyadh).

Variable	Study 1	Study 2
Reference	**Al-Hazzaa,1990**	**Al-Refaee & Al-Hazzaa,1997**
Reason (%)		
Do not have time	**62.7%**	**47.3%**
Lack of place or space	**17.3%**	**23.5 %**
Medical reason	**7.3%**	**9.9%**
Fear of embarrassment	**4.3%**	**9.2 %**
Not convinced of benefits	**____**	**4.1%**
Miscellaneous	**8.4 %**	**6.1%**