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Review

The Training Effects of Dance Aerobics: A Review with an Emphasis on the Perspectives of Investigations

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A B S T R A C T

The training effects of contemporary aerobics programmes (hi lo, dance aerobics, step aerobics, aqua aerobics etc.) have been frequently investigated. However, we found no recent paper which reviewed aerobic programmes with regard to their training effectiveness, characteristics of the subjects involved, variables of interest and experimental design. In this paper we summarise the findings of more than 40 studies published in the 2000–2011 period that investigated the training effects of different forms of contemporary aerobics. In this review, the studies are grouped according to their characteristics (sample of subjects, variables of interest, study design, effects, etc.). Around 80% of the investigations dealt with females, with adults being most commonly observed. In the majority of investigations, the authors studied different variables at the same time (morphological anthropometric, motor, cardiovascular, biochemical indices, etc.). In recent studies a trend toward a psychological status examination is evident. In most instances positive training effects on motor-endurance and varsity of physiological variables are declared throughout a training period of 8 to 12 weeks. However, the positive changes in anaerobic endurance are not evidenced. Knowing the tendency of the overall increase of certain psychological disorders in population (including depression) there are indications that future, potentially highly interesting studies will deal with the psychological status of adults and older subjects.

***Key words**: efficiency, endurance, motor status, testing*

Introduction

In the 1960s Dr Kenneth Cooper coined the term »aerobics« when trying to describe all the activities performed in aerobic working conditions[1]. Although these were very simple training activities (e.g. walking, running, skipping, swimming, some sport games), the results of the research Dr Cooper conducted on some US Air Force personnel confirmed their efficiency regarding an improvement of the cardiorespiratory status (CRS). Based on these and some new ideas on the need to develop and improve CRS, at the end of the 1970s Jackie Sorenson, a choreographer and dancer, brought this kind of exercise closer to the general population by creating dynamic exercising to music which, due to Jane Fonda's promotion and strong media support, quickly conquered the world, particularly the female population. The American College of Sports Medicine (1998) defines aerobics (aerobic exercising) as »any form of physical activity performed by activating large muscle groups, in a relatively long time period (over 20 minutes) with a basically cycling character«[2]. This kind of activity is determined by a work intensity of: 50 to 85% of maximum oxygen consumption (VO_{2max}) and/or 60–90% of maximal heart rate (HR_{max}). Nowadays, aerobics can be grouped according to several forms (modalities) of work: (I) natural forms of movement (walking, running, cycling, rowing etc.) during which the exerciser maintains a continuous or slightly discontinuous form of work; (II) simulated natural forms of movement achieved by applying so-called cardio fitness equipment (e.g. work on a stepper, cycle ergometer, rowing ergometer etc.); and (III) contemporary aerobics, i.e. »dance« aerobics (cyclic polystructural activity with a great number of types, mostly discussed in this paper). The term contemporary aerobics' involves all movement structures performed to music which, through

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its rhythm and tempo, closely brings the movement and its influence together to form a unique entity. Due to it being performed to music and the dance steps following a choreography, this kind of exercise is called »Aerobics dancing« or »aerobic dance« Nowadays, this group involves a large number of work modalities such as the classic HI LO programme, step aerobics, slide aerobics, new body, jazz aerobics, funky, latino, salsa etc.[3] Namely, the popularity of modern aerobics is considered to have surpassed the popularity of all other training forms. The reasons for this can be found in its investigated and proven training effectiveness, together with its supported motivational base[4]. As a result, aerobics has become a valuable training modality for top-level athletes and people with several mild health problems, while it has also been used in the recreation of children, adults as well as the elderly. Therefore, researchers have frequently focussed on the aerobic benefits. The purpose of this paper was thus to objectively review studies which have examined aerobics with regard to its training effects (TEs), and to identify some of the key characteristics of the studies that have dealt with this issue over the last 10 years.

Methods of Data Collection

For the purpose of identifying all relevant articles we searched the following databases: Pub Med, Scopus, Science Direct, Current Contents and Google Scholar. During this search, we used the following key words: »aerobics«, »aerobics dance«, »step aerobics«, »bench step«, and »aqua aerobics« combined to the terms such as »effect«, »change«, »impact« and »influence«. The articles had to meet the following criteria: to have focussed on the TEs of aerobics, to have been published between 2000 and 2011, to have been written in English. The articles were first searched based on their titles, then summaries, and eventually based on the whole text to exclude those not fulfilling the mentioned criteria. Where the complete text could not be obtained from the basis in which a certain article was indexed, the authors of the studies were contacted. In addition to the overlap of certain articles in several bases, and by combining various key words, 30 relevant papers were found. The key word combinations and numbers of papers found were as follows: »aerobics« and »effect« (2 papers); »aerobic dance« and »effect« (8 papers); »step aerobics« and »effect« (3 papers); »bench step« and »effect« (3 papers); »dance-based exercise« and »effect« (2 papers); »aqua aerobics« and »effect« (4 papers); »aerobics« and »change« (1 paper); »aerobic dance« and »change« (3 papers); »step aerobics« and »change« (0 papers); »bench step« and »change« (0 papers); »dance-based exercise« and »change« (0 papers); »aqua aerobics« and »change« (0 papers); »aerobics« and »impact« (1 paper); »aerobic dance« and »impact« (1 paper); »step aerobics« and »impact« (0 papers); »bench step« and »impact« (0 papers); »dance-based exercise« and »impact« (0 papers); »aqua aerobics« and »impact« (0 papers); »aerobics« and »influence« (2 papers); »aerobic dance« and »influence« (0 papers); »step aerobics« and »influence« (0 papers); »bench step« and »influence« (0 papers); »dance-based exercise« and »influence« (0 papers); »aqua aerobics« and »influence« (0 papers). All of the studies were analysed with regard to: (I) the subjects grouped by sex (male, female, mixed sample); (II) the subjects' age; (III) the subjects' medical status (healthy, non-healthy); (IV) the variables analysed in the investigation (motor, endurance, psychological, biochemical variables etc.); (V) experimental design (we grouped studies into those where authors observed only one aerobic programme and those where authors observed two or more such programmes in a differential manner); (VI) the type of research (longitudinal, transversal or follow-up); (VII) the length of treatment (in weeks); and (VIII) the conclusions regarding the obtained effects (physiological, motor, morphological and psychological parameters). This approach allowed the usual statistical calculations (frequencies, percentages) for every single outcome (from I to VIII). The findings are grouped and discussed in the following text.

Review

Characteristics of the subjects involved in the studies

Of the total of 30 studies analysed in this review paper, 23 studies, i.e. 77%, were conducted on women, and only two on men[5,6] while five research studies (17%) were conducted on a mixed sample[7–11]. In general, contemporary aerobics was basically created for females. This is because aerobics programmes are performed to music, use certain dance choreography and therefore require a certain sense of aesthetics, rhythm and a sense for music. In general, these programmes are mainly advertised (and initially developed) to target a female population and it is therefore logical that women are the most frequent participants of aerobics. Given this, the relatively small share of studies dealing with males is not a surprise.

Although aerobics is highly popular even among younger ages[2–4], it seems that authors of recent studies are mainly oriented to somewhat older subjects when studying the training effects (TEs) of different kinds of aerobics. For the purpose of this review, we grouped subjects into age categories where »adults« involves an age span of 22–40 years. On the whole, more than 50% of the studies conducted involved adults and older subjects (aged 40–60). The lack of studies which dealt with younger subjects is most probably related to the fact that it is hard for younger subjects to achieve the TEs of aerobics exercise.[2,4] Namely, it is generally proven that a significant decrease of most motor-endurance capacities together with evident negative trends in morphological features (i.e. a decrease in lean body mass along with an increase in body fat mass) is observable in adults, especially at older ages.[12–14] Therefore, in the adult and older one'saerobics programmes provide valuable training stimuli which can preserve and even improve one's motor-endurance and morphological status. Additionally, in

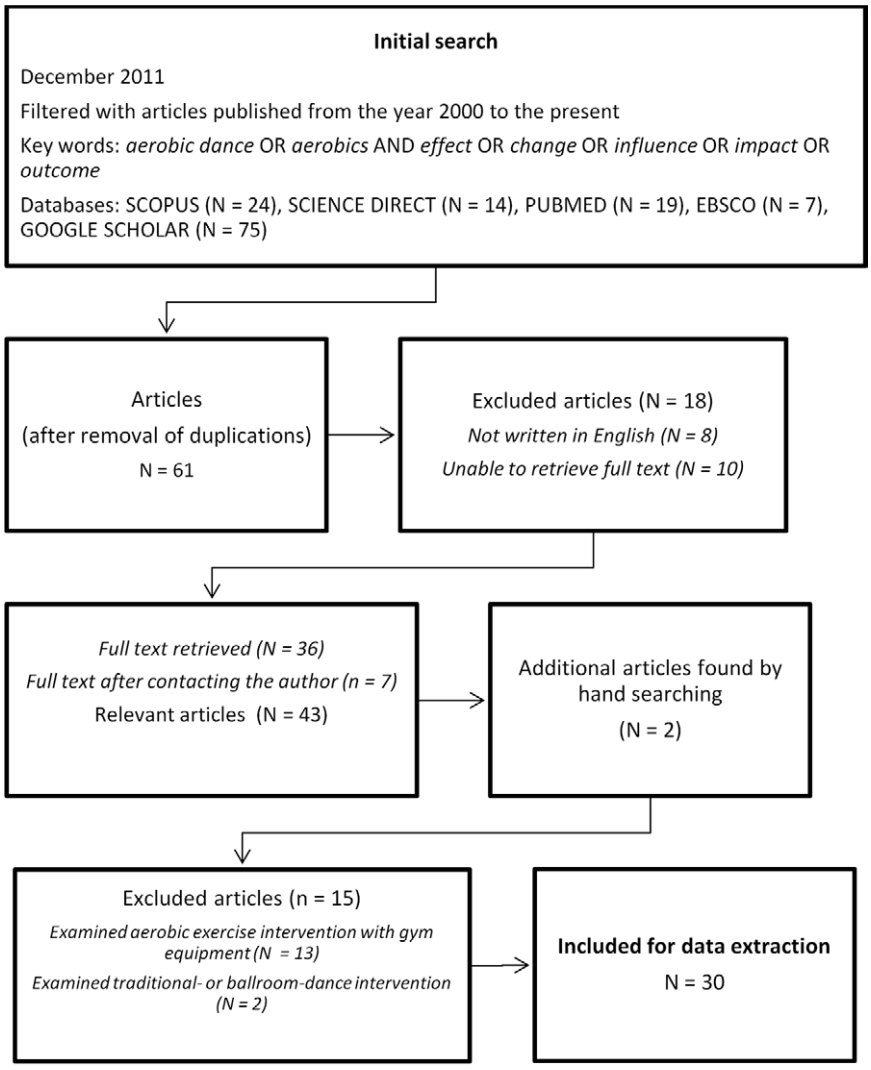

Fig 1. Flowchart of the review process.

such investigations one can easily prove the final differences between the control and experimental group considering the analysed variables (i.e. even if the experimental group did not improve its status, the control one will almost certainly have a negative trend in the measured variables). Consequently, apart from the fact that the motor and functional effects of aerobics programmes are clearly beneficial, we cannot ignore the possibility that, when selecting their samples, researchers most frequently choose adult respondents since for them it is less difficult to prove the TEs they were studying. However, one should not ignore the fact that when they started in the 1970s aerobics programmes were targeted at adults. The programmes were then promoted in the media by adult celebrities (e.g. Jane Fonda and Jackie Sorensen) who were then aged over 30, and they were created for the very purpose of satisfying the needs of adult-age groups. These two factors (the TEs of aerobics programmes, and the suitability of aerobics for this age) are the main reasons that, out of 30 analysed research studies, the biggest share sampled respondents of an adult and older age.

A significant proportion of studies even dealt with very old subjects even very old persons (+70 years of age; 20% of the total number of research studies analysed in this paper)[7–9,15–17]. This refers to adapted aerobics programmes which do not have the characteristics of dance aerobics but are mostly performed in certain stationary programmes, quite frequently while sitting on a chair, and organised in various institutions providing care for very old people within their physical exercise programmes. Interestingly, almost all the recent studies we reviewed[7–9,15–17] examined the effects of an aerobics programme on a sample of very old people, allowing us to conclude that we will witness an increase in such investigations in the future. This will most probably be triggered by the overall interest of older participants in aerobics. In short, older persons will be familiar with such a kind of exercising (i.e. it is probable that they participated in such programmes when they were younger).

Out of the 30 studies, 26 or 87% were conducted on a sample of healthy respondents (i.e. included subjects with no health and/or motor aberrations), while four studies (13%) analysed respondents with some kind of health problems[18–21]. Aerobics programmes are basically intended for healthy persons. This is logical since most aerobics are performed in groups[2,3]. This reveals that aerobics programmes are not highly reliable and precise in the assessment and application of training intensity like, for instance, cardio-fitness training programmes. These factors make it logical that most research studies sampled healthy respondents since they do not bring any risk into the experimental procedure itself and investigators don't have to put special attention on this (i.e. it almost certainly allow investigators to focus on other important experimental problems). Supportively to previously stated, we have to note that even in those studies where the authors sampled non-healthy subjects there were no study risks. Namely, the subjects (examinees) in these four studies[18–21] mostly suffered from fibromyalgia, rheumatic arthritis and multiple sclerosis, which are not observed as risk factors in aerobics' participation, unlike certain kinds of cardio-vascular or respiratory-pulmonary problems.

Experimental study designs

Of the 30 research studies, only six (20%) conducted a differential analysis of the programmes[22] (i.e. they analysed two or more different aerobic types). This is not surprising considering that when considering TEs in aerobics programme research, in addition to the group performing the programme a control group must always also be engaged. When studying differential effects, this most frequently means we must have two groups attending different programmes, and a third one which is a control group. Such an experimental approach clearly requires that a larger number of subjects is involved, making implementation of the experimental procedure more complicated. However, the studies conducted so far (see below) mainly confirmed the TEs of a certain aerobics programme, leaving some space to determine which aerobics programmes (modality) are more efficient than others, and for which parameters. Therefore, one can expect that in future the studies which will investigate the TEs of an aerobics programme will have a differential experimental design.

Authors rarely examined motor, anthropometrics, physiological or psychological parameters exclusively, and in most studies different variables were observed. This is not surprising knowing that aerobics are generally considered as exercise program with various training-influences[3,6]. Knowing the significant increase of the depression symptoms in the overall (especially adult and older) population[23] the trend of recent investigations which have largely presented evidence of TEs on psychological variables[24–26] will be briefly discussed. Namely, the World Health Organisation reported a prediction that up until 2030 depression will be the second leading cause of death. This has also been emphasised by sport science and aerobics programmes are thus considered to be highly beneficial (i.e. being performed in multiple motivating environments which provide a highly positive atmosphere in addition to music, the instructor and the group). In this regard, researchers have been interested in determining aerobics programmes' potential effects on the psychological status. Therefore, in the future one might expect a larger number of papers dealing with this topic. This is especially important knowing that such studies could be done in a short time period since some psychological variables change significantly under the influence of just one training session (for instance depression and anxiety). Accordingly, the positive consequences of long-lasting participation in aerobics programmes can be predicted. Investigations of functional parameters (maximum oxygen consumption and CRS) were popular in the 1980s [27–31] considering the data showing a high percentage of mortality due to diseases of cardio-vascular and respiratory-pulmonary systems, although nowadays programmes tailored to this segment of the anthropological status are most often performed by applying cardio-fitness equipment, making aerobics programmes not particularly interesting from this point of view.

Most studies were done over a period of 8 to 12 weeks[4–7,9,11,15,18–20,25,26,32–38], and only one study analysed the effects of treatment over a period of 4 weeks[21]. There are also studies with a longer experimental procedure where the longest treatments lasted for 24[8,16,22,39] or even 48 weeks[40]. In short, any changes (particularly in morphological anthropometric characteristics) can only be expected after a certain number of trainings. Therefore, it is meaningless to study aerobics programmes in periods shorter than 1.5 to 2 months, particularly if we take into account that energy expenditure during an aerobics session ranges from 8–10 kcal/min[41]. Cases where authors observe changes in morphological anthropometric indices are particularly important.

Training effects observed

Of the studies we analysed, 13 studied physiological parameters[8,9,11,18,19,22,32,34,36,38,39,42]o – _ENREF_28 and 12 found significant changes in the observed variables. Yet one study did not find significant effects, and it is worthwhile discussing it briefly. In this investigation[11], the authors studied anaerobic endurance measured by the Wingate test, as well as the fatigue index, which are basically anaerobic endurance parameters. It is surprising that they decided to become engaged in such a study in the first place given that one of the main assumptions of an aerobics programme is working in aerobic conditions. Training in aerobic working conditions gives no grounds to expect changes in the anaerobic status of the respondents, but the mentioned study is obviously original from this point of view and was published in a prominent journal, so the question is how the study began. However, the authors of this paper contacted the author of the mentioned study and discovered that it formed part an extensive, already partially published research study. Therefore, it is not surprising that the author then published a

separate paper which analysed anaerobic performances, i.e. the influence of an aerobic programme on anaerobic endurance. However, it may be concluded that studies of aerobic programmes most probably do not need to be conducted for the purpose of identifying efficiency regarding a change in anaerobic endurance since the programme generally has an aerobic character.

Out of the studies analysed here, 14 investigations[4,7–9,11,15,16,20,21,33,34,36,39,43] focused on the motor status independently, or together with other variables. These 14 research studies proved changes in motor variables where strength and flexibility variables were most frequently studied. Basically, these conclusions are not surprising considering that in most cases the authors sampled adults and older subjects (see the text above for more details).

The eight researches which studied the psychological status of respondents under the influence of an aerobics programme proved the efficiency of aerobics programmes regarding an improvement of acute or chronic psychological status[10,17,24–26,35,37,40]. As previously explained, such studies are becoming more popular.

All seven of the studies overviewed in this review found significant changes in anthropometric variables, mainly referring to reduced body fat measures and/or an increase in lean body mass[4–6,8,22,32,43]. As stated above where the length of treatment was analysed, research studies focusing on morphological variables are conducted over relatively longer periods. This is particularly observed in the context of the respondents' age. As stated previously, most studies were conducted on respondents of an adult age. At adult age, negative trends of inactivity are significantly present, thus in fact physically inactive adults accumulate adipose tissue and suffer from a decrease of lean body mass. When such people, particularly women, become involved in organised physical exercise programmes positive trends in their anthropometric status are expected.

Conclusions

Studies addressing the training effects of aerobics have generally dealt with adult women and examined non-differential effects of approximately 12-week-long aerobics programmes on various variables. In general studies confirmed training efficacy of the aerobic on physiological and motor-endurance variables. However, the effects of the aerobic dance on the anaerobic endurance were not proven.

In the future, we may expect that studies will be more frequently conducted on differential bases. In short, investigators have already verified the significant training effects of aerobics while the question of a differential influence remains unsettled.

In addition, and according to the growing trend of studies providing evidence on psychological variables, we may emphasise that psychological status will also be a focus of future investigations.

Adapted aerobics programmes conducted as part of physical exercise schedules in various health-care institutions providing care for very old people will almost certainly also become a trend in the future. In a large number of cases these subjects will be motivated to participate in such exercise as it is quite likely that they regularly trained aerobics previously (while younger).

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TRENING UČINCI AEROBIKE: PREGLEDNI RAD S NAGLASKOM NA SMJERNICE BUDUĆIH ISTRAŽIVANJA

S A Ž E T A K

Trening učinci suvremenih programa aerobike (hi-lo, plesna aerobika, step aerobika, itd.) često se istražuju. Međutim, nismo pronašli ni jednu recentnu studiju koja je sistematski prikazala aerobik programe po pitanju njihove trenažne učinkovitosti, karakteristika ispitanika uključenih u istraživanje, mjera koje su analizirane ili eksperimentalnog dizajna. U ovom radu saželi smo rezultate više od 40 studija koje su objavljene u periodu od 2000–2011, a koje su se bavile trening efektima suvremene aerobike. Studije su grupirane u odnosu na ispitanike, varijable, dizajn istraživanja, itd. Okvirno 80% studija istraživalo je žene, a najveći broj istraživanja bavi se odraslim osobama. Autori istražuju različite varijable istovremeno (antropometrijske, motoričke, kardiovaskularni status, biokemijske pokazatelje, itd.). U posljednje vrijeme istraživanja se sve više bave psihološkim parametrima i periodima od 8 do 12 tjedana treniranja. Mada u većini analiziranih parametara autori izvještavaju o značajnim efektima treninga aerobike, pozitivne promjene u mjerama anaerobne izdržljivosti nisu uočene. S obzirom na poznatu tendenciju porasta psiholoških problema u populaciji (uključujući i depresiju), postoje sve pretpostavke da će se parametri psihološkog statusa i njihova dinamika pod utjecajem programa aerobike istraživati u budućnosti, i to posebno kod odraslih i starijih.