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The positive effects of online group singing on psycho-physiological variables during the COVID-19 pandemic—A pilot randomized controlled trial

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Abstract

The psychological variables that were particularly influenced by social distancing during the COVID-19 pandemic—stress, loneliness, social participation, and well-being—correspond closely to variables that can also be influenced by music. The present study is a pilot randomized controlled trial examining the effects of online group singing on psycho-physiological variables during the pandemic. Over 4 weeks, an online singing group sang together once a week, for 1 h, under the guidance of a professional voice coach. In a first control group, participants also met for 60 min per week but only discussed and exchanged personal experiences about music. A second control condition consisted of a waiting list group. Across all variables studied (positive and negative affect, life satisfaction, stress, loneliness, social participation, self-efficacy, and body perception), positive effects were revealed in the singing group and in the discussion group, but not in the waiting list group. The effects of the variables self-efficacy, social participation, loneliness, and life satisfaction were markedly stronger

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in the singing group than in the discussion group. The results demonstrate the effectiveness of group singing on a number of psycho-physiological variables, which can be used profitably in and outside of times of crisis, in both clinical and non-clinical settings.

KEYWORDS

choir, COVID-19, loneliness, self-efficacy, singing, stress

INTRODUCTION

Music connects. Although the evolutionary origins of human musicality—composing, making, and listening to music—are not conclusively understood, it is likely that music harmonized social interactions throughout history, acting as “social cement.” Music might have assisted in coordinating group activities, mediating social identity and delineation, and enabling pre-linguistic communication, perhaps contributing to the survival of our ancestors (Huron, 2001; Koelsch, 2013). The reverberations of these biologically beneficial uses of music are still clearly visible, as social connectedness is considered one of the fundamental dimensions of the use of music in everyday life (Schäfer et al., 2013). The connecting role of music during times of crisis or threat can be supported by its particular salience throughout the COVID-19 pandemic. In times of social distancing, people stepped out onto their balconies and began to sing and play instruments, which was followed by a social response back through spontaneous participation and applause. Here, musical interrelatedness signaled human connectedness, belonging, and togetherness—in many countries worldwide, reflecting the universal nature of social connectedness through music. In addition to the social component, music is also used for self-regulation and for the regulation of mood and psycho-physiological arousal (Schäfer et al., 2013). These two modes of use were particularly prominent during the pandemic, as numerous detrimental circumstances often led individuals to experience more stress, lower life satisfaction, fewer positive affects, and more worry and anxiety. Beyond the social connective properties, studies have also shown that the pandemic also intensified the use of music, particularly in relation to music listening (Fink et al., 2021; Ziv & Shabtai, 2021). Expanding on these findings, the aim of the present study was to investigate whether the described positive effects of music could be specifically stimulated by offering individuals the opportunity to sing together online during the pandemic. Here, we present a controlled, randomized pre–post study on the effects of participation in an online singing activity in Germany in the year 2021.

THE POSITIVE EFFECTS OF SINGING

Everyday non-professional singing, whether experienced alone, with family, friends, or in an amateur choir, is associated with numerous psychological and physical variables. Particularly well-documented are improvements in general mood, positive affect, positive psycho-physiological arousal, and subjective well-being, as well as decreases in negative affect such as anxiety (Grape et al., 2002; Kreutz et al., 2004; Sanal & Gorsev, 2014; Unwin et al., 2002; Valentine & Evans, 2001). Increases in subjective well-being have also been observed in individual studies with measurable

increases in oxytocin levels, which is understood to be a biological marker for increased feelings of social connectedness (Kreutz, 2014).

Compared to solo singing, singing in a group setting often quickly leads to a sense of social connectedness (Pearce et al., 2015). Increases in well-being are also more pronounced when singing in a group (Stewart & Lonsdale, 2016). In one of the few long-term studies conducted on the subject, Linnemann et al. (2017) also found greater improvement in mood and a more pronounced decrease in stress as a result of choral singing. However, no differences between choral singing and solo singing, in terms of increases in feelings of happiness and decreases in worry and sadness, were found (Schladt et al., 2017). Additionally, results of a qualitative study with choral singers included an increase in experienced connectedness as well as physiological benefits (e.g., better breathing), cognitive stimulation, enjoyment, and transcendence (Moss et al., 2018).

In elderly populations, singing has been associated with positive effects on pain, sleep quality, and dementia (see Wan et al., 2010), as well as better general health when active in amateur choirs (compared to professional choir singers; Pentikäinen et al., 2021). In a randomized controlled trial (RCT), Galinha et al. (2022) showed a significant increase in well-being, positive affect, and self-esteem among elderly participants.

Well-documented physiological effects of singing include the strengthening of respiratory muscles and the optimization of breathing, as well as an increase in the concentration of oxytocin and endorphins, which is considered indicative of improved immune defense and well-being (see Kang et al., 2018). Similarly, a reduction in general physiological tension and an increase in heart rate have also been observed (Grape et al., 2002; Valentine & Evans, 2001). An open-ended survey with a qualitative evaluation revealed positive effects on breathing and lung function, posture and body control, relaxation and stress, and energy level within a sample of choral singers (Clift et al., 2009; see also Moss et al., 2018).

These findings demonstrate promising, positive psycho-physiological effects of singing. However, it should be noted that the methodological quality of these studies is very heterogeneous, with methodologically sophisticated study designs (RCTs, longitudinal studies) still being the exception (see also Habibi et al., 2022; Reagon et al., 2016). For this reason, an RCT was conducted for the present study.

THE PSYCHOLOGICAL CHALLENGES DURING THE PANDEMIC

Throughout the COVID-19 pandemic, multiple lockdowns and “social distancing” measures led to major challenges for citizens. In addition to economic stresses, psychological stresses have been the focus of many recent empirical studies. Findings within the context of the pandemic have revealed increases in depression and anxiety, as well as decreases in general life satisfaction and satisfaction with one’s own health (Ammar et al., 2020; Hettich et al., 2022; Pandya & Lodha, 2021). In a country like Germany with almost 17 million single-person households, loneliness also became a highly researched variable in this time, as it forms the antithesis of social connectedness and is a social–emotional part of personal well-being and life satisfaction. Studies have shown that feelings of loneliness increased significantly as a result of social distancing (Entringer & Kröger, 2021; Lippke et al., 2022), as opportunities for social participation decreased. Social participation refers to the possibility of autonomous and self-determined access to places, communities, and activities that serve personal expression, communication, personal (creative) development, and the reception of art and culture in groups. With quality

of life, equality of opportunity and self-development in the foreground of social participation, social distancing measures severely curtailed these aspects. Furthermore, the aforementioned variables are not independent of one another: studies have shown that loneliness has a negative impact on physical health, life satisfaction, and well-being (Hawkey et al., 2003; Hawkey & Cacioppo, 2010; Luo et al., 2012; Park et al., 2020). It can therefore be assumed that these variables covaried during the pandemic.

Social distancing measures were experienced as stressors by most of the population, leading to a significant increase in perceived stress levels, recently termed “COVID Stress Syndrome” (Brooks et al., 2020; Taylor et al., 2020). The long-term psychological consequences of the measures (especially with regard to chronic stress, stress disorders, anxiety, and depression) can hardly yet be estimated. Taylor (2019) even argues that the psychological consequences of the pandemic could be far greater than the medical consequences, long-term.

THE POTENTIAL OF ONLINE SINGING DURING THE PANDEMIC— AIM OF THE CURRENT STUDY

The intention to conduct the present study within the context of pandemic-related challenges was founded on the promising research on the effects of singing. A methodologically valid design (controlled and randomized) was used to strengthen the pre-existing evidence on the specific effects of group singing. A set of psycho-physiological variables that appeared relevant in preliminary studies was used. The study aimed to investigate whether group singing can lead to a meaningful improvement in variables that were negatively affected by the pandemic response measures.

Within the context of the COVID-19 pandemic, it can be argued that social distancing measures primarily negatively influenced social aspects (social participation and loneliness), resulting in further psychological impairments (depressiveness, anxiety, and reduction of well-being). In the introduction, we noted the special role of music as “social cement.” Similarly, Koelsch (2013, p. 204) identified seven social functions of music: “individuals have contact with other individuals, engage in social cognition, participate in co-path (the social function of empathy), communicate, coordinate their actions, and cooperate with each other, leading to increased social cohesion.” These social functions of music are part of a total of over 100 different functions that have been found empirically and can be categorized under three basic dimensions: *self-awareness* (e.g., identity formation, coping with problems, and emotions), *social relatedness* (communication, expression, and communality), and *mood and arousal regulation* (Schäfer et al., 2013). Interestingly, with historical reference to, for example, the Plague of Milan, Chiu (2020) identified the same three musical functions, each of which increases greatly in importance during times of crisis such as the COVID-19 pandemic, and which people deliberately utilize through ritualistic, sometimes religious-like practices such as balcony singing: mood maintenance, social cohesion, and the use of music for achieving self-awareness. These findings are further supported by a qualitative study of balcony singing in Italy by Antchak et al. (2022) and extended by the aspect that such shared musical practices serve to build social and creative resources. Thus, across the three basic dimensions of the use of music, the potential of music to positively influence psychological variables affected by the pandemic is inferred: Regarding the dimension of self-awareness, it is expected that group singing will increase positive affect, decrease negative affect, reduce perceived stress, and increase self-efficacy. Regarding the dimension social relatedness, an increase in the feeling of social participation and a decrease in

loneliness are expected. Regarding mood and arousal regulation, an improvement in general life satisfaction is expected.

In keeping with some of these expectations, a recent qualitative study from the United Kingdom found that well-being was enhanced and feelings of social identity were strengthened after participating in an online choir during the pandemic (Daffern et al., 2021). However, a reduction in “co-creation” was also found, that is, the sense of strong physical, emotional, and social connection with others that otherwise leads to experiences of transcendence and high embodiment, often experienced in traditional live choirs. In line with our expectations, past studies have shown that variables such as self-efficacy further act as resilience factors, thus partially buffering negative psychological effects caused by stressful conditions (Havnen et al., 2020; Schnell & Krampe, 2020). The finding that the time spent listening to music increased measurably during the pandemic (Ziv & Shabtai, 2021) indicates that many people are aware and make use of the positive effects of music (see also Hennessy et al., 2021). Using data from six countries on three continents, Fink et al. (2021) showed that musical engagement (listening to and making music) increased strongly during the first lockdown in 2020 and was deliberately used as a coping strategy. Differentiated strategies emerged among respondents: While stronger engagement with *listening* to music was associated more with the motive of finding solace, stronger engagement with *making* music was associated more with the motive of generating “positive affect, such as relaxation, good mood, and meaningful aesthetic and spiritual experiences—aspects that could be linked to regulation strategies such as revival, entertainment, and strong sensation” (p. 9).

METHOD

Design of the study

In an RCT, three conditions were compared: singing in an online singing group, discussing music in a group setting, and a waiting list control group. The singing group represents the theoretical group of interest. The specific offer of an online singing group was developed by a professional music educator and voice coach (www.sing-mit-arianeroth.com). The participants joined the online singing group through a video platform. The participants were able to see each other as a video tile on the screen and could thus adjust and coordinate their physical movements with those of the other participants. The participant microphones remained muted for the duration of the singing component in order to account for possible distortions in audio signals, because of technical delays, as well as to help participants feel comfortable singing with others. This created a low-threshold offer and made participation attractive to a broad target group. Previous group singing experience or having “a good voice” was not necessary. The voice coach could be seen and heard at all times, guiding the singing group. Over a period of 4 weeks, the singing took place once a week for 60 min per session. After short physical and vocal exercises, the group members sang together to simple pop songs and chants that had been selected in advance, which were produced and sung by the coach. For easy execution, lyric videos were displayed for each song. The participants were encouraged to sing along while standing or sitting upright and to move to the music as they wished. Guided reflections took place to notice changes in the body after singing sessions. The sessions also included discussions and personal exchanges about the chosen music, as well as personal singing experiences. As some of the proposed outcomes were expected to already occur through participants meeting and exchanging ideas, a first control condition was implemented. In this discussion group, the participants met for 60 min per week

and discussed and exchanged personal experiences about music, under the moderation of the same coach. This control condition aimed to isolate the potential effects of group singing in the treatment condition. A second control condition (waiting list group) was formed in order to quantify the treatment effects. Individuals in this group participated in both questionnaire time points, 5 weeks apart, but received no intervention at the time of the study. The participants in both control groups were offered the prospect of participation in the online singing after the end of the study period. The intervention took place in October 2021. The second lockdown ended in May 2021. The month of October was a comparatively quiet phase of the pandemic with relatively stable cases. Social distancing was no longer in effect at this time, but the hygiene measures and spacing were, and therefore live choirs were also not possible. A link to the questionnaires was emailed to the participants and they were completed online. The first questionnaire was sent the week before the start of the intervention, with a request to complete it within the next 2 days. The second questionnaire was sent the week after the intervention, again with the request to complete it within the next 2 days.

Recruitment and composition of the sample

The participants for the study were recruited through the singing coach's website, through her mailing list, through advertisements on social media, and through a mailing list at the university that included psychology students. Invitations also asked individuals to share the link to study participation with friends and acquaintances. A total of 74 interested individuals signed up to participate in the online study and received all further instructions directly through the coach's web portal. Although a sample size of at least 50 participants per condition was sought, this could not be realized after repeated calls for study participation. It is possible that acute pandemic-related conditions led to lower participation motivation. Therefore, the convenience sample obtained is not a random sample from the population, consisting instead of individuals who were interested in participating in an online singing group as well as those who wanted to contribute to a scientific study. Expectancy effects with regard to the measured variables can therefore not be ruled out, which made the inclusion of the waiting list control group particularly important. Sampling bias because of non-random drawing can also not be ruled out but was accepted for reasons of economy when recruiting the sample. Although preceding studies suggest that different samples do not differ significantly with regard to the effects of music (Schäfer et al., 2013; Schäfer & Riedel, 2018; Schäfer & Sedlmeier, 2010), the generalizability of the present study's results is limited. So, eventually, the small sample size and the use of a convenience sample led us to classify the current study as a pilot study.

The 74 enrolled participants were randomly assigned to one of the three conditions. The participants completed the questionnaire (see below) before the start and after the end of the study, that is, at an interval of about 5 weeks. As compensation for participating in the study, all participants received the otherwise paid for service of the online singing offer free of charge, with the singing group during the study and the remaining two groups post-study. The participants were informed about the study's aims and procedure, giving their written consent to participate and to the processing of their anonymized data. The participants were asked to generate a personal identifier code in order for the anonymized data to be correctly assigned to the same participant at both assessment time points.

Measurements

The participants completed the following questionnaires at both assessment time points.

Stress

The German version of the Perceived Stress Questionnaire (PSQ; Fliege et al., 2009) was used to assess the experience of stress. It consists of 20 Likert-type items in which respondents are asked to indicate their agreement on a response scale of 1–4. The normalized range of the total score is between 0 and 100.

Positive and negative affect

The German version of the Positive and Negative Affect Schedule (PANAS; Breyer & Bluemke, 2016) was used to record positive and negative affect. The intensity of 10 positive and 10 negative affects is recorded on Likert items, with a response scale of 1–5. The responses were subsequently averaged.

Self-efficacy

Self-efficacy was assessed using the General Self-Efficacy Short Scale (Allgemeine Selbstwirksamkeit Kurzskala, ASKU; Beierlein et al., 2012). It consists of three Likert-type items, in which respondents are asked to indicate their agreement on a response scale of 1–5. The responses were subsequently averaged.

Social participation

The perception of social participation was assessed using the Short Scale for the Assessment of Perceived Social Participation (Kurz-Skala zur Erfassung wahrgenommener sozialer Teilhabe, KsT-5; Berger et al., 2020). The first five Likert-type items were used, for which respondents are asked to indicate their agreement on a response scale of 1–4. The responses were subsequently averaged.

Loneliness

Loneliness was assessed using the three-item short version of the UCLA Loneliness Scale (Hughes et al., 2004), with the German translation of the items adopted from Spitzer (2016). The total score consists of the sum value of the three items, which can range from 3 to 9.

Life satisfaction

Life satisfaction was assessed using the Short Scale to Assess General Life Satisfaction (Kurzskala Lebenszufriedenheit, L-1; Beierlein et al., 2015). The one-item scale has a range of 0–10.

Body awareness

Apart from the above-mentioned physiological effects of breathing, relaxation, and body control, no specific expectations regarding possible changes in the perception of one's own body through group singing existed. The author also knows of no empirical findings on this subject, to date. However, as the coach reported positive physical experiences from her work and thus suggested recording physical changes, this aspect was included in the present study. As there were no

established instruments measuring body perception in a way relevant to our study, six items were formulated in collaboration with the coach: (1) I can usually feel my body consciously. (2) I can usually feel how my body is doing. (3) I can feel when my breath becomes tight and no longer flows freely. (4) I feel in touch with my body. (5) I feel when my body tenses up. (6) I usually speak consciously and feel my body. The participants could indicate their agreement on a response scale of 1–10. The responses were subsequently averaged. The scale showed good reliability: Cronbach’s alpha = .79 at pre-measurement and .90 at post-measurement.

The sociodemographic variables of age and gender were assessed at the first interview time point.

Desired minimum effects

Based on practical considerations, specific expectations of the effectiveness of group singing were derived. Effects were considered practically relevant when item responses varied between assessment points by about one scale point, on at least half of the items used for instruments with few scale points (i.e., four or five), or about one scale point on all items for instruments with many scale points (i.e., 10 or 11). For example, for the Likert-type items of the PSQ assessing stress, this would mean a change from “frequently” to “sometimes” (i.e., one scale point out of a possible four) in at least 10 of the 20 items used. For life satisfaction, with response possibilities ranging from 0 to 10, a change of at least one scale point was expected. Specifically, we expected a change of 16 points on the PSQ, 0.5 points each on the PANAS, the ASKU, and the KsT-5, as well as one point on the scales recording life satisfaction and body perception. On the UCLA Loneliness Scale, a reduction of at least one scale point on at least one of the three items was expected. A reduction of one scale point was thus also expected for the corresponding sum score.

RESULTS

Characteristics of the sample

Of the 74 total participants, the data of 45 individuals were included in the study. Individuals who did not take part in the second questionnaire or for whom the two identifier codes did not match were excluded from the final analyses. The included sample consisted of 39 women and 6 men, with an age range between 20 and 75 years ($M = 49.5, SD = 11.5$). A total of 15 participants were allocated to the singing group, 14 to the discussion group, and 16 to the waiting list group (see Table 1). Nine participants reported to have never learned an instrument or taken singing lessons; 15 reported having learned an instrument or taken singing lessons as a hobby but do not practice regularly, and 21 reported regular musical participation for several years. No participants reported having received professional instrumental or singing training. A total of 18 participants had previous experience in choral singing, and 6 participated in other choral activities during the study period (see Table 1).

TABLE 1 Descriptive characteristics of the participants

	N	Age		Gender		Previous experience N (%)	Other activities during study N (%)
		M	SD	N female (%)	N male (%)		
Singing group	15	46.3	9.9	13 (87)	2 (13)	6 (40)	2 (13)
Discussion group	14	53.9	7.6	12 (86)	2 (14)	7 (50)	2 (14)
Waiting list group	16	46.8	13.6	14 (88)	2 (12)	5 (31)	2 (12)

TABLE 2 Descriptive characteristics of the variables studied and their change over the two measurement points

	Pre		Post		Difference		Group × time interaction η_p^2
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	ΔM	<i>d</i>	
<i>Perceived stress questionnaire (PSQ, 0–100)</i>							.11
Singing group	51.6	20.6	41.0	22.3	−10.6	−.58	
Discussion group	44.0	18.9	33.6	13.4	−10.5	−.57	
Waiting list group	47.8	17.5	47.4	15.7	−.42	−.02	
<i>Positive affect (PANAS, 1–5)</i>							.03
Singing group	3.4	0.9	3.8	0.7	.40	.60	
Discussion group	3.6	0.5	3.8	0.6	.17	.25	
Waiting list group	2.9	0.7	3.1	0.6	.16	.23	
<i>Negative affect (PANAS, 1–5)</i>							.10
Singing group	2.4	0.9	2.1	0.7	−.33	−.49	
Discussion group	2.1	0.6	1.7	0.5	−.38	−.57	
Waiting list group	2.1	0.6	2.2	0.6	.11	.17	
<i>Self-efficacy (ASKU, 1–5)</i>							.14
Singing group	3.9	0.9	4.2	0.8	.29	.38	
Discussion group	4.3	0.5	4.0	1.0	−.26	−.34	
Waiting list group	3.9	0.6	3.8	0.7	−.17	−.22	
<i>Social participation (KST, 1–4)</i>							.04
Singing group	2.8	0.7	3.1	0.4	.27	.53	
Discussion group	2.8	0.4	3.0	0.5	.14	.28	
Waiting list group	2.5	0.5	2.6	2.1	.08	.15	
<i>UCLA-loneliness-scale (UCLS, 3–9)</i>							.05
Singing group	6.2	2.1	5.3	2.2	−.93	−.54	
Discussion group	5.2	1.4	4.8	1.7	−.43	−.25	
Waiting list group	4.9	1.6	4.9	1.3	<.001	<.001	
<i>Body perception (1–10)</i>							.19
Singing group	6.8	1.9	7.5	1.9	.64	.43	
Discussion group	6.8	1.3	7.6	1.1	.77	.51	
Waiting list group	6.8	1.2	6.3	1.5	−.47	−.32	
<i>Life satisfaction (0–10)</i>							.08
Singing group	6.2	2.5	7.4	1.8	1.20	.65	
Discussion group	6.9	1.6	7.6	1.9	.79	.42	
Waiting list group	6.1	1.7	6.1	1.4	<.001	<.001	

Note: Difference is the difference between the pre-measurement and the post-measurement. Group × time interaction is the ANOVA effect for the interaction between time (pre, post) and group. ANOVA, analysis of variance; PANAS, positive and negative affect schedule.

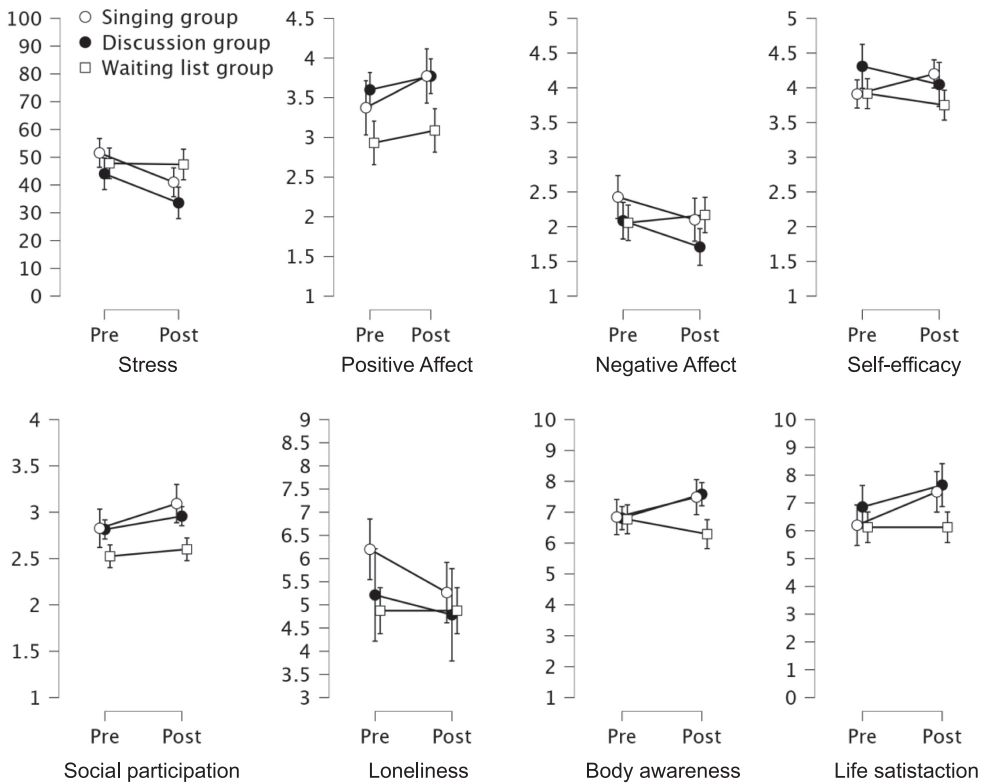


FIGURE 1 Group-specific changes in the variables studied over the two measurement points. Note: For better interpretability, all figures show the entire possible range of values of the instruments used.

Group-specific changes in outcome variables

Table 2 and Figure 1 show the changes in the outcome variables from the pre-measurement to the post-measurement across the three groups.

For perceived stress, the expected change of 16 points on the PSQ was approximately reached with about 11 points, with similar effects observed in both the singing group and in the discussion group. No change was observed in the waiting list group. Therefore, although the findings indicated a meaningful reduction in subjectively experienced stress in the treatment group, this might not only be a singing-specific effect but might also be achieved through conversations on music, when also conducted in a group setting.

A singing-specific effect was found for the variable positive affect. An increase of 0.4 points was observed for positive affect in the singing group, which comes close to the expected increase of 0.5 points. Both the discussion group and the waiting list group showed effects about half as large, whereby the increase in positive affect for the waiting list group cannot be explained within the context of the present study.

Negative affect decreased similarly in both the singing group and in the discussion group, again indicating a non-singing-specific effect. The effect remained noticeably below the expectation, perhaps lying on the border of perceivable change.

The clearest singing-specific effect was observed for general self-efficacy, which increased in the singing group and decreased in the two control groups. Although the increase here of about 0.3 points lies under that of the expected value, the positive change in the singing group clearly

stands out and marks an interesting effect: as self-efficacy can be regarded as a stable personality trait that usually changes little over the lifespan (Gecas, 1989), a change is a promising indication for an effect mechanism triggered by group singing.

A singing-specific effect was also found for the feeling of social participation, with a change of about 0.3 points. Although still below the expected value, the effect indicates a great potential for an interesting mechanism of action through group singing. Perhaps unsurprisingly, the discussion group also showed an improvement—about half as large—in the feeling of social participation. No change was observed in the waiting list group.

The reduction in subjectively experienced loneliness was also strongest in the singing group and, with around 0.9 points, almost reached the expectation of 1.0 point. As expected, the effect in the discussion group was about half as large, with no effect observed in the waiting list group.

Regarding change in body perception, the singing group and the discussion group indicated positive changes, and the waiting list group a negative change. The first two groups revealed relatively strong effects, indicating clear changes in individual items, but did not reach the change expectation of about one scale point.

The strongest effect of the study was observed in an improvement in life satisfaction in the singing group, which exceeded the change expectation with 1.2 points. As expected, a positive change was also observed in the discussion group, but this was markedly smaller. No difference was seen in the waiting list group.

DISCUSSION

Singing as a group in an online amateur choir is a low-threshold, enjoyable, collaborative activity that has been shown to have a number of positive psycho-physiological effects. In the current study, these effects were systematically investigated using a randomized controlled pre–post design. Positive effects were found for all variables examined, some of which were specific to group singing while others emerged from discussing music in a group setting. The timing of data collection was not chosen at random: the COVID-19 pandemic and the accompanying measures of social distancing made it necessary to transfer existing choirs to a digital format, and a systematic investigation of the potentials of an online singing activity in this psychologically challenging and stressful time was considered of high importance. Our positive findings might not only contribute to the quantification of the effects of amateur singing on psycho-physiological variables but might also form the basis for future interventions through including group singing as a way to cope with particularly stressful situations. After all, amateur singing is an intervention that can be implemented easily, inexpensively, and is also free of deleterious side effects.

In the following, we summarize the results along the three basic functional dimensions of music according to Schäfer et al. (2013). With regard to the dimension of self-awareness, possible changes in the variables positive and negative affect, stress, and general self-efficacy were examined. The clearest singing-specific effect emerged for the variable general self-efficacy. As self-efficacy is a central personal resource for adapting to stressful circumstances and life events, it can be seen as a resilience factor. This is, arguably, the most relevant result of the present study. In this result lies a great potential not only for offers in the amateur sector but also for music therapy interventions. A qualitative survey showed that intense emotional experiences from simply listening to music are used as resources in difficult life situations (Schäfer et al., 2014). However, beyond times of crises or stress, a high capacity for self-efficacy has been shown to be a key to personality development and supports the realization of personal goals. The reduction of stress and negative affect was similar in both the singing group and in the discussion group. Although

this positive effect can be seen as practically useful, it is not singing specific. However, this does not diminish the relevance of the finding, as future interventions can still be useful without necessarily having to include group singing components. This is reflective of qualitative studies, which indicate that shared activities can have “therapeutic” benefits, no matter the content of the shared activity (Lamont & Ranaweera, 2020). A partial singing-specific effect was also observed for increases in positive affect. We can only speculate about why this effect was also partially observed in the waiting list group: perhaps, the mere knowledge of participating in a study or the prospect of participating in the online singing soon already altered participant perceptions. In addition, the peak periods of the pandemic were characterized by very rapidly changing conditions, information, and challenges, such that some changes in the outcomes may have occurred during the 4-week period of data collection that cannot be explained within the scope of the present study. As Xia et al. (2021) demonstrated using two 14-day diary studies, COVID-19-induced stress levels fluctuated strongly, whereas emotional variability increased markedly. The slight increase in positive affect in the waiting group could thus be because of such a temporally local fluctuation.

Regarding the dimension of social relatedness, we observed possible changes in the variables loneliness and social participation. For the reduction of loneliness, we found a partial singing-specific effect, whereas the effect in the discussion group was only half as large. Therefore, group singing might reduce feelings of loneliness more than mere social sharing, possibly because singing creates a “product” that can only be worked on together, extending beyond the individual (Lamont & Ranaweera, 2020). Another explanation is the possible release of oxytocin through singing, as presented in the introduction. A partial singing-specific effect was also shown for feelings of social participation, which was only half as large in the discussion group. As previously noted, singing is characterized by working together on creating a common product. It can be argued that the variables loneliness and social participation are among those of greatest relevance in mitigating or subsequently curing the effects of social distancing. Against the background of the high number of single-person households in Germany, loneliness is a social factor that should not be underestimated, and for which musical offers and interventions represent an easy and effective possibility for individuals to combat social isolation. Beyond acute crisis-related contexts, these interventions might also be relevant for the growing elderly population—a group often reported to be struggling with loneliness and dwindling opportunities for social participation—because of limited mobility and the loss of friends and relatives. Although often not accessed, musical offers hold great potential for this population group (see Castillejos & Godoy-Izquierdo, 2021; Schäfer & Riedel, 2018).

With regard to the dimension of mood and arousal regulation, possible changes in general life satisfaction were observed. A very large and partial singing-specific effect was found, which was only half as large in the discussion group. The result that group singing achieves such a large advantage compared to group discussions is a promising result. As introduced above, life satisfaction is influenced by other variables that can be changed by singing itself. A partial singing-specific effect was found for loneliness and social participation, perhaps explaining the increases in life satisfaction. It can also be argued that, in the relationship between group singing and life satisfaction, a partial mediating effect of loneliness and social participation might exist. As presented above, the effect of group singing on life satisfaction is in line with findings from previous studies.

The variable body perception was recorded based on the personal experience of the singing coach. It can be argued that this variable is most in line with the dimension of self-awareness. The conscious perception of one's own body and breath changed equally in the singing group and in the discussion group, indicating a moderately strong effect. If there is a substantial effect here—which would have to be isolated more clearly in subsequent studies, e.g., with the help of more suitable instruments still to be developed—it does not seem to be limited to group singing. Nevertheless,

this effect also offers potential for offers or interventions that address not only the psychological but also the physiological variables, for which—as shown above—very little evidence currently exists.

Limitations

The current study was deliberately designed as a field experiment in order to combine the advantages of an experiment (high controllability and high internal validity) with the advantages of a field study (high external validity and high relevance to everyday life; see Habibi et al., 2022). With this study, we also aimed to demonstrate and evaluate a possible path for a low-threshold intervention within the context of a current social, economic, and personal crisis situation. Although our findings are promising, their significance remains provisional. Here, a sample size that would ultimately allow a robust generalization of the results was not achieved. Therefore, replications and extensions of the design are needed, as is the attempt to generate representative samples for specified populations, possibly differentiated by age group.

The design included two control conditions to quantify the specific effectiveness of group singing in absolute terms (versus a waiting list group) and in relative terms (versus an alternative treatment group). The validity of the alternative treatment depends largely on its specific content. During implementation, great importance was attached to ensuring that the alternative treatment group was comparable to the intervention group, with group singing being the isolated variable. Nevertheless, a singing and voice coach presumably always leads to advisory or therapeutic effects, even when only discussing music, without group singing. This may explain, for example, the comparable effects on body perception in both the treatment and alternative treatment groups. Future studies should therefore include an active control condition, guided by another person.

About 40% of the participants had previous experience with choral singing, and two people per group were involved in other musical activities outside of the online singing group. As discussed above (Daffern et al., 2021), people who were singing in a live choir before the pandemic might have made frustrating experiences when suddenly being forced to sing online, potentially leading to attenuated effects. However, the online singing group was installed as a new offer; it was not an online continuation of an initial live choir. And, more importantly, none of the participants' open comments indicated any frustrating experiences. Instead, all were very happy to have been given the chance to participate in the online singing activity.

Not least, the term “online singing group” should be understood in light of what was concretely done in the current study. The online singing group differed from a real choir in that the common product, that is, the audible result of singing together, was not present. Chiu (2020) uses the neat expression “singing separately together” to describe this specific kind of singing activity. There is thus a certain element of shared experience, or co-creation (Daffern et al., 2021), missing, which may have dampened the effects. However, it is well conceivable that online singing groups or real online choirs will become a genre of musical activity in their own right in the future—even outside of crises or lockdowns.

CONCLUSION

The current study shows medium to large effects of an amateur online group singing activity across a variety of psycho-physiological variables. These effects support and quantify the (specific) effectiveness of group singing activities and provide methodologically robust evidence for the benefits of musical offerings and interventions in the non-clinical domain, which can be accessed within and outside of crisis situations.

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CONFLICT OF INTEREST

The author declares that there is no conflict of interest.

ETHICS STATEMENT

The study was conducted in accordance with the WMA Declaration of Helsinki and the ethical guidelines of the German Psychological Society (Ethische Richtlinien der Deutschen Gesellschaft für Psychologie e.V. und des Berufsverbands Deutscher Psychologinnen und Psychologen e.V., <https://www.dgps.de/die-dgps/aufgaben-und-ziele/berufsethische-richtlinien/>), which is a German adaptation of the “Ethical Principles of Psychologists and Code of Conduct” (*American Psychologist*, 2002, 57, 1060–1073; standards 3.10 and 8.01 to 8.15). The participants were informed about the study’s aims and procedure, giving their written consent to participate and to the processing of their anonymized data (see Page 8).

DATA AVAILABILITY STATEMENT

The data of the present study are freely available at <https://osf.io/cpvs8/>.

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