International
Journal
Of Advanced Research in Engineering & Management (IJAREM)
ISSN: 2456-2033 || PP. 01-20

Two Consecutive Days of Intermittent Fasting Did Not Influence Individual Work Performance, Mood, and Distraction at Work

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Abstract: Background: There is an ongoing debate on the topic of Intermittent Fasting (IF) and whether this dieting method is either beneficial or detrimental for working individuals who decide to abstain from food at work.

Aims: To determine whether two consecutive days of fasting have an influence on work performance, distraction, and mood at work. Social support, fasting experience, age, and gender are also observed as confounding variables.

Design: This was a quasi-experimental, within-participants study, with repeated measures design (three measurement points, one per week), and a replication of Appleton and Baker's (2015) study, with some alternations.

Method: 33 participants (13 males and 20 females) aged between 21-54 fasted for two consecutive days at work. Measures were taken one week preceding, during, and after the fasting intervention.

Results: MANOVA reported a statistically insignificant difference of IF on work performance, distraction, and mood across the three weeks study.

Conclusion: Two consecutive days of IF did not influence cognitive performance at work in the given sample size. These findings can contribute to the field of Occupational Psychology by informing cohorts that the choice of abstention from food at work does not influence individual work performance, mood, and distraction at work.

Keywords: intermittent fasting, work performance, distraction, mood.

Introduction

Literature Review

In recent years, the concept of fasting (the abstention from food), used as a dieting method, has been approached with more popularity (Freire, 2020). This is seemingly because fasting is considered cost-effective, accessible to individuals, and may treat or ameliorate certain health issues (Di Francesco *et al.*, 2018). For example, caloric restriction (CR) or Intermittent Fasting (IF) are primarily deemed useful practises for weight loss purposes (Johnstone, 2015), but to also improve the reproductive system and mental health in women (Nair & Khawale, 2016), and even prevent cancer and ameliorate obesity in general (Freire, 2020).

However, fasting has already been known for centuries and practised, for religious purposes, by Christian, Muslim, and Buddhist populations (Persynaki *et al*, 2017). Some examples of such popular religious fasting include the Orthodox Christian fasts (it is instructed by Biblical Scriptures to fast for 180-200 days each year) (Trepanowski & Bloomer, 2010) and the Holy Month of Ramadan, during which time, an estimated number of one billion Muslims fast from dawn until dusk (Massoud *et al.*, 2020). Although religious types of fasting are practised primarily for the purification of the soul and body, they elicit the same health benefits as other fasting methods, such as the reduction of the risk of diabetes, cancer, cardiovascular diseases, and hypertension (Massoud *et al.*, 2020). Nevertheless, the most widely known method of fasting practised at any time across the year is IF (Kohok, 2019).

IF is defined as the abstention of food during a pattern of hours (Cherif *et al.*, 2015) and it has become more popular since 2014 (Volpe, 2019). According to Pike (2019), there are three main methods of IF: these are the 16:8 ratio (16 hours of fasting where only plain water is permitted, and the remainder 8 hours are an open window for caloric intake); the 5:2 ratio (5 days of habitual eating and 2 days of fasting; where 500-600 calories per day are allowed); and the 24-hour fasting method, recommended to be practised no more than twice a week, where no caloric intake is allowed except for plain water, tea, and coffee during the 24 hour fast. Overall, the premise is that, during periods of abstention from food, the

body rejuvenates cellular processes, metabolic pathways, and hormonal secretions due to a lower blood pressure, lower glucose, and therefore reduced body fat (Freire, 2020), hence the prevalence of health benefits.

Despite IF's physical benefits, there is an outward interest in examining if IF is beneficial or rather detrimental to working individuals, who decide to abstain from food at work (Volpe, 2019). For instance, whilst some studies suggest that fasting at work can improve the cognitive function through the regulation of the inflammatory response pathway (Cherif *et al.,* 2015; Shojaie *et al.,* 2017), other studies conveyed that the evidence for this relationship is not clear (Gudden *et al.,* 2021) and not conducted sufficiently in humans (Harder-Lauridsen *et al.,* 2017). This is not only explained by the lack of literature in this area (Volpe, 2019), but also due to existing findings being controversial (Benau *et al.,* 2014), hence making it unclear to determine if the practice of IF during working hours is considered to enhance intellectuality or rather a contributor to poor performance at work. It can therefore be suggested that more research on this topic would be helpful.

Particularly, cognitive aspects, such as distraction (as a consequence of IF), mood (e.g., feeling joyful or irritated at work), and Individual Work Performance (IWP) (e.g., time management, overall performance, or counterproductive behaviour at work) are less investigated. To date, the only study which focused on the influence of IF on mood, distraction and, work performance at work is the study of Appleton and Baker (2015). This study portrayed that lower positive mood was (independently from IF) associated with higher distraction at work. However, this paper initially operationalised distraction as a consequence of IF and upon further investigation found that distraction was a factor which may contribute to cognitive effects of IF (i.e., lower mood and work performance). Nonetheless, this research did not utilise a valid measure for distraction, but rather used 5 generic questions related to distraction. This could pose a problem because, according to Food Attention Bias approaches (FAB) (Beard *et al.,* 2012; Lev-Ari *et al.,* 2021), it is underlined that during periods of hunger, individuals pay more attention to food related stimuli than neutral stimuli. Therefore, distraction could be a consequential effect of hunger and a replication of this study (using a valid measure for distraction) could be beneficial to test this finding further. In this report, distraction will be referred to as a consequence of IF, rather than a factor of cognitive effects.

Controversies in the literature

Despite various types of fasting, studies reported similar benefits of this practice. For example, a longitudinal study (1 year) consisting of 112 participants, found that both IF and CR resulted in physical improvements, including lowered cholesterol and blood pressure and improved weight management (Sundfør *et al.,* 2018). This finding coincides with that of Song and Kim (2022), who proposed that both IF and CR can control body weight and improve glucose homeostasis and the anti-inflammatory effects. Therefore, it could be stated that despite the choice of fasting method, individuals could benefit from a range of physical wellbeing effects. However, some would argue that there is not sufficient evidence to determine if IF has any influence on cognitive functioning in relation to work efficiency and capability (Taylor *et al.,* 1957; Poole & Henson, 1988), unless practised regularly (as a lifestyle), where it was shown to decrease the chances of developing cognitive impairment diseases (Ooi *et al.,* 2020). Equally, more recent findings claim that there is no clear evidence of a positive short-term effect of IF on cognition in working individuals (Gudden *et al.,* 2021). Nevertheless, Scholtens *et al.* (2020) argued that the 5:2 ratio was reported to be a safer method for weight loss due to participants naturally seeking out foods composed of various nutrients recommended to be beneficial for physical wellbeing (i.e., high protein, low carbohydrates), after breaking their fast. Moreover, IF can contribute to longer life, the diminishment of age-related diseases and the regulation of cardiovascular diseases and cholesterol issues (Cherif *et al.,* 2015). Hence, there is a plethora of evidence to suggest the variety of benefits regarding physical performance. However, the influence of IF directly on cognitive matters, especially work performance, mood, and distraction, which may be typically more demanding at work (Nezhad, 2015), are less investigated and therefore minimally understood. Similarly, Campante and Yanagizawa-Drott (2013) suggested that these factors are less explored due to them being empirically complicated to test, and hence this issue resulted in mixed study findings in the past. Thus, it is crucial to examine the differences in the existing literature methodology approaches in order to distinguish a possible answer which could explain the contentious study findings.

Consequently, the different methodologies used to establish the effect of IF on working individuals is one explanation of the radically different findings of previous studies. For example, Owen *et al.* (2011) investigated IF's influence on memory following an overnight fast (during sleeping hours) and found that higher doses of glucose intake, taken when breaking a fast, resulted in a short-term increase in working memory performance

the following day. This finding is in line with that of Gupta *et al.* (2016), who underlined that shift workers ought to consider resisting food intake during the night to achieve an optimal performance (e.g., performance on the Psychomotor Vigilance Task) during the day. Therefore, it could be understood that a night fast may result in increased cognitive performance. Nevertheless, the study of Gupta *et al.* (2016) is not entirely reliable as it only consisted of 10 participants and therefore could be perceived to have weak external validity, and hence compromising its generalisability (Robson, 2011). Additionally, fasting during sleeping hours may be considered easier to practise than fasting during working hours (when one could be more physically and cognitively demanded), although there is no scientific research to date to sustain this statement; though there is literature (Facer-Childs *et al.*,2018; Fong *et al.*, 2015) to suggest that differences in chronotypes (i.e., morning vs night person) can result in outcomes of performance during daytime (i.e., daytime sleepiness, psychomotor vigilance, executive function, and isometric grip strength). However, studies which investigated factors contributing to enhanced performance in night shift workers supported the concept that a partial re-entrainment to a night shift schedule (Smith *et al.*, 2009) and the consumption of coffee during a night shift (Bohle & Tilley, 1993) both contributed to improved mood, fatigue, performance, and subjective alertness. Hence, whilst night-time fasting may be beneficial, as suggested (but not sufficiently evidenced) by previous research, daytime fasting and its influence on essential factors for work (i.e., work performance, mood, and distraction) remain insufficiently explored and understood.

Furthermore, the literature does not seem to focus on similar factors and measures in a consistent fashion; for example, whilst Owen *et al.* (2011) investigated overnight fasting, which led to enhanced working memory performance, Smith *et al.* (2009) examined the functionality of the circadian rhythm, rather than introducing any fasting intervention over the course of one week. Therefore, it could be understood that Smith's prolonged intervention, which led to cognitive benefits, may suggest that IF is not the direct cause of improvement of cognitive aspects, but rather this is the result of an adaptation of an adequate circadian rhythm. Relatedly, the current statistics revealed that only 5.9% of the UK population currently works nights shifts (Colliass *et al.*, 2023). Therefore, as most workers tend to work during the day, the need for more research on IF's influence on the discussed cognitive aspects during the day is essential in the understanding of how workers' routine may be affected by their choice to practise IF at work.

Subsequently, studies which investigated the influence of IF during the day reported different results compared to both overnight fasting and other daytime fasting interventions. For instance, after two consecutive days of IF (16:8 ratio), the subjects of Appleton and Baker's (2015) pilot study reported that distraction, not IF, was an independent moderator of mood and perceived performance. Despite this, Qian *et al.* (2022) explained that influences of mood at work (i.e., depression/anxiety-like feelings) are sometimes affected by a misalignment between the central circadian clock and daily activities and this disruption can decrease positive mood by as much as 26.2% and is not necessarily determined by IF. Other studies found a relationship between IF and cognitive performance at work, despite this being negative. For example, in a short-term fasting study on cognition, Benau *et al.* (2014) indicated that participants scored lower in performance (i.e., memory recall) and attention (i.e., alertness) in the afternoon (after a few hours of fasting), which underlines that IF can have negative influences on cognitive performance at work even after a few hours of fasting. Similarly, Green *et al.* (1994) found that IF negatively influenced intellectual functions, such as the inability to concentrate and memory. However, the latter was a systematic study, which investigated fasting alongside food deprivation and hypoglycaemia, which is seen to be comorbid with hypertension (Tran *et al.*, 2015), rather than a choice to abstain from food. Given that, studies highlighted that hypertension is associated with poorer attention, learning and memory, and other executive functions or visuospatial skills (Waldstein, 2003). Hence, it cannot be directly supported that IF can negatively influence memory, as this cognitive function can be impacted by hypertension. Thus, it might be suggested that more research is needed in order to draw more convincing arguments.

Nevertheless, other forms of more updated daytime fasting research, such as during Ramadan (Campante & Yanagizawa-Drott, 2013; Nugraha *et al.*, 2017), suggested that daytime abstention from food negatively influenced mood (i.e., feeling irritable) and sleep, which could ultimately influence work performance (Rad *et al.*, 2022). On the other hand, a few studies reported beneficial effects of IF on cognitive factors and mood. For example, Seidler and Barrow (2022) implied that IF led to the optimisation of cognitive performance (i.e., memory, learning, and attention), an improvement of performance (but not specifically at work), and resilience, although their mechanisms remain unclear. Yet, IF has been reported to be a safe and well-tolerated therapeutic method for patients with mood disorders (Fond *et al.*, 2013). Similarly, a recent meta-analysis found that other methods of fasting (i.e., during Ramadan) may alleviate stress, anxiety, and depressive symptoms (Berthelot *et*

al., 2021). Therefore, due to mixed study findings, there is a necessity to conduct more research (especially replications) to distinguish the real effect of IF on mood and other cognitive functions.

Additionally, a few studies have shown that certain confounding factors may influence cognitive aspects during periods of hunger. For instance, it was portrayed that freshly employed workers tend to be more satisfied with their jobs compared to earlier hired employees (Radhakrishnan, 2020). This finding is similar to Taylor *et al.* (1996) who found that a longer tenure led to decreased commitment in managers and increased turnover. Conversely, a meta-analysis supported that a longer tenure resulted in greater role performance (Ng & Feldman, 2010). Therefore, it would be interesting to closely inspect the effect of job tenure within the current study. Additionally, younger employees seemingly experience lower job insecurity anxiety compared to older aged employees, and hence reported better work-life balance, job satisfaction and enjoyment (Mauno *et al.,* 2013). Thus, it seems ideal to examine a potential association between age and mood at work and determine if mood is influenced by IF or other factors. Furthermore, studies examined a relationship between mood and individuals' previous fasting experience (amount of accumulated time in which one has practised fasting) and found that people with less fasting experience were observed to have a greater appetite, and a lower negative mood (Alsaeed *et al.,* 2019; Ma *et al.,* 2021); the study of Ma *et al.* (2021) considered it important to examine fasting experience, when conducting research on fasting. Hence, the current study examines any potential influence of job tenure, age, and fasting experience in relation to IF. Moreover, gender (Scholz *et al.,* 2013) and social support were deemed to moderate the effect of hunger on cognitive aspects, including the motivation to continue fasting and enhancing positive mood (Karfopoulou *et al.,* 2016; Harter *et al.,* 2020). However, due to limited literature on these two variables and their potential effect during IF, the current study explores them further.

To date, the only study which attempted to investigate the unexplored topic of IF's influence on mood, distraction and work productivity is the pilot study of Appleton and Baker (2015). However, as stated previously, a major limitation of this study is the lack of a valid measure for distraction, thus their results could not provide a valid conclusion. Moreover, as it was a pilot study and it consisted of only 16 participants, their results could not be extrapolated (Boukrina *et al.,* 2020), hence there is a necessity for a replication of this study with a larger sample size in order to draw a more convincing assumption. By using a validated questionnaire to measure distraction, the current study could test if mood and individual performance are truly moderated by distraction and not IF, as suggested in the study being replicated. The current study could have the potential to partially contributing to cover the gap in the literature and provide a clearer understanding of the effects of IF on work performance, mood, and distraction at work.

Moreover, Spector and Pindek (2016) highlighted that the field of Occupational Health Psychology is substantially dominated by the theory-based deductive approach and implied that more experimental studies are needed to develop this field, therefore the current study could provide that. Furthermore, if IF is established to enhance work performance and mood, this could be a feasible method to increase IWP and mood, which were suggested to have a positive knock-on effect on the prevention of turnover, high job satisfaction and productivity, and the reduction of employee turnover (Miner & Glomb, 2010; Krekel *et al.,* 2019); or if IF will be observed to heighten distractibility at work, this information could inform business psychologists of a means of possible prevention for distractibility at work.

Based on all the above, the current study aimed to answer the following research question: 'What is the influence of IF on individual work performance, mood, and distraction?'. The following 3 hypotheses were tested: Hypothesis 1. There is a significant difference in participants' work performance before, during, and after two consecutive days of IF. Hypothesis 2. There is a significant difference in participants' mood, before, during, and after two consecutive days of IF. Hypothesis 3. There is a significant difference in participants' distraction, before, during, and after two consecutive days of IF.

Methodology

Design

This study was a longitudinal, quasi-experimental study with three measurement points, and a replication of the study of Appleton and Baker (2015). It adopted a quantitative, within participants design with repeated measures. This design was found the most applicable due to its effectiveness in assessing change over time and having high control over variables (Girden, 1992). However, a limitation of this design is order effects; participant's performance may be enhanced or worsened across conditions due to subjects memorising their answers or becoming fatigued (Girden, 1992). To address this limitation, the current study was spread across three weeks, with one intervention taking part per week (i.e., Week 1, no fasting. Week 2, fasting. Week 3, no fasting), and subjects completed the survey in one of their fast/non-fast day. This change was an alteration from

the replicated study, where the survey was completed by participants in both days of each intervention. Another adjustment was the measures used for distraction and IWP, due to a higher reliability, which will be explored in the materials section. The independent variable was Intermittent Fasting (IF), which was operationalised as the subjective perception of hunger, and the dependent variables were IWP (Koopmans *et al., 2013*), mood (Watson & Tellegen, 1988), and distraction (Broaddbent *et al.,* 1982).

Sample size

Although the study initiated to have twenty-five participants (according to G*Power, for one group being measured across three observations, an alpha of .05, a power of .95, and a small effect of .01 the sample size should be a minimum of 25), thirty-three participants took part in the study (20 females and 13 males) and the age range was 21 to 54 (M = 29.79, SD = 8.47). The inclusion criterion comprised of working individuals over the age of 18. The exclusion criterion consisted of participants with existing severe health issues; participants who were under any medications or at any type of risk for the duration of the study. This is because IF may have a risk on individuals who are diagnosed, for example, with diabetes, due to a decrease in blood sugar levels (Noon *et al.,* 2016). Participants were recruited through snowball and convenience sampling and the researcher used both their personal (i.e., Facebook and Instagram) and professional (i.e., LinkedIn and the University Research Database) networks to recruit them. The choice of sampling methods is due to their low-cost and effective approach in finding and recruiting participants, who take part voluntarily, meaning that the likelihood of a drop-out rate is lower (Byrne, 2011).

Materials

Participants used their own devices to complete the questionnaire. An advertisement poster was used to search for participants (see Appendix 1.1). Moreover, the study was hosted on Qualtrics (Provo, UT) due to its participant-friendly simplicity. Three questionnaires were used to measure each dependent variable.

IWP was measured using the Individual Work Performance Questionnaire (IWPQ) (Koopmans *et al.,* 2014), as it presented to have a strong Cronbach's alpha of 0.79-0.89, suggesting a strong reliability of the questionnaire; according to Tavakol and Dennick (2011), the Cronbach's alpha ranging between 0.70 to 0.95 suggests a high reliability of a questionnaire. Moreover, the study of Appleton and Baker (2015) examined 'perceived work performance'. However, this is deemed to be over/underestimated by individuals, depending on certain traits (i.e., being overconfident) (Merting & Hoffeld, 2014), whereas the IWPQ is considered a reliable and valid instrument for measuring work performance among workers from different occupational sectors, therefore this was seemingly a more applicable tool (Koopmans *et al.,* 2014). This questionnaire incorporated 3 sub-scales (task performance, which refers to planning and performing work; contextual performance, meaning completing initiative tasks, and counterproductive work behaviour, focusing on or producing negative work behaviour, such as complaining at work). Refer to Appendix 1.2 for examples of items of this questionnaire. Participants were asked to score using two different 5-point scales from 1 (seldom) to 5 (always) for 'task performance and contextual performance', and 1 (never) to 5 (often) for 'counterproductive work behaviour', as instructed by the authors of this questionnaire (Koopmans *et al*., 2013). The Cronbach's alpha for each sub-scale, based on the current sample was 0.87 for task performance, 0.95 for contextual performance, and 0.84 for counterproductive work behaviour, hence suggesting that they were highly reliable.

Mood was measured using all 20 items of the Positive and Negative Affectivity Schedule (PANAS scale) (Watson & Tellegen, 1988), which reported a 0.91 Cronbach's alpha for the positive items and 0.87 Cronbach's alpha for the negative items, hence indicating high reliability; and because it was used in the study being replicated. The positive scale refers to positive feelings, such as feeling interested, whereas the negative scale indicated negative aspects, including feeling ashamed (see Appendix 1.3). On a matrix table, participants were asked to score on a 5-point scale from 1 (Slightly or not at all) to 5 (Extremely). The Cronbach's alpha for sub-each scale, based on the current sample was 0.95 for the positive items and 0.82 for the negative items.

Distraction was measured using the Cognitive Failure Questionnaire (CFQ) (Broadbent *et al.,* 1982) due to its strong Cronbach's alpha of 0.79. As previously stated, the study of Appleton and Baker (2015) did not use a valid measure to examine distraction, but rather 5 questions related to distraction, therefore the current questionnaire was selected for better accuracy. Similarly, this questionnaire can be used for any individuals, including those with cognitive impairments, whilst continuing to provide accuracy of responses (Gillen, 2009) (see Appendix 1.4). Participants were asked to score from 0 (never) to 4 (Very Often). The Cronbach's alpha for this scale, based on the current sample was 0.85.

Procedure

Initially, participants were given an anonymous Qualtrics link (relevant for Week 1 measurement point) via email/WhatsApp and were asked to complete it after a day at work, in the week preceding IF. Once they were given the link, participants were reminded that they were not required to fast for the completion of the first and third survey and were asked to provide their availability for each consecutive week to complete the separate survey links (i.e., the two consecutive working days for week 1, then for week 2, and ultimately week 3). The first page of the Qualtrics survey contained the Participation Information Sheet (PSI) (see Appendix 2.1) and the requirements of the study. Then, participants were asked to create a 4-character code and were informed that they will need this for the duration of the study, to withdraw or for any other support with their data. The consent form was then displayed and the 'forced response' Qualtrics option was used to enable participants to consent before continuing. Next, participants were required to provide the following demographic information: age, gender, any mental or physical health (no participants disclosed any severe health problems), job tenure, social support, and fasting experience. Refer to Appendix 2.2 for the operationalisation of these variables. Then, participants were asked to score the three sets of questionnaires (in order; IWP, CFQ, and PANAS), measuring the dependent variables. After answering the three sets of questionnaires, participants were required to answer how hungry they felt during the day (to operationalise the independent variable, namely, IF) to which they could answer from 1 (not at all) to 5 (extremely). At the end, participants were presented the Debrief Form (see Appendix 2.3) and the participation was complete. After this point, participants were unable to go back and record/edit their answers, which was also applicable for the remaining two questionnaires.

In Week 2, participants were required to fast for two consecutive days during their working hours, when they were allowed to eat no more than 500 calories per working day and to drink any amount of water. However, their nutritional intake and working hours were not formally recorded. At the beginning of the second fasting day, participants were contacted with the second link and were asked to complete it after their day at work. Once the link was accessed, participants could revise the PSI, log in with their 4-character code and start completing the survey in the same sequence as Week 1, starting with the IWPQ. This time, participants were not required to provide their demographic information, as per in Week 1, apart from their age and gender to allow identification in case they forgot their code and required assistance with their data. This was done to avoid predisposing participants to fatigue before answering the rest of the questionnaire. After completion of all the 3 questionnaires, participants were presented the Debrief Form and once that was done, the measurement for Week 2 was complete.

In Week 3, participants were not required to fast, but they were advised to follow their habitual eating style. They were contacted with the last Qualtrics link. Then, participants were asked to log in with their 4-character code, read the PSI, record their age and gender and then their answers for the three different questionnaires in the same order as in Week 1 and 2, starting with IWPQ. After logging their answers, participants were presented with the Debrief Form and thanked for their participation in the study.

Ethical Considerations

This study was approved by the University of East London's School of Psychology Research Ethics Committee (see Appendix 3.1). Participants' consent was obtained through the consent form handed out to subjects at the beginning of the study. Furthermore, the study was anonymous and confidential, as participants' real names were not used at any point of the research; instead, all subjects were asked to create a unique 4-digit code. Moreover, all participants were informed about their right to withdraw from the study at any time without any consequences. Additionally, although participants were not involved in deception, they were only informed of the nature of the research and not its aims; this was done to avoid any biased inclinations on the scores. Moreover, participants' personal details and data were securely stored in separate UEL's One Drive for Business folders, which were locked with link access. The anonymised dataset was only accessible to the researcher and the supervisor, whereas the raw data was only accessible to the researcher, and both are still being kept until a maximum of 3 years post study. Finally, although it was not expected that participants would experience any physical or psychological harm due to their participation, they were informed of the possibility of IF to cause fatigue, frustration, poor concentration, slower reaction times, and poor mood. Hence, participants were provided with contact details of free access organisations, such as the Student Wellbeing via the Hub (for students from University of East London) or the Samaritans and the NHS mental health services (accessible to anyone). Furthermore, the researcher was at low risk of wellbeing distress, in which circumstance, they were advised to contact their supervisor and/or the UEL Wellbeing Team and discuss the support available to facilitate this risk.

Additionally, measures were taken to prevent lack of biases when collecting, analysing, and interpreting the data (Miyazaki & Taylor, 2007). For example, there was a risk of volunteer bias (i.e., subjects would not represent a general population, but rather a particular group). To prevent this, the researcher recruited participants from distinct platforms, including personal and professional networks. Similarly, there was a risk of potential instrument bias (i.e., the use of a sequence in the provided questionnaires which may point the participant to the direction of the study, and hence enable them to provide 'expected answers'). To prevent this, the researcher placed the independent variable question at the end of all the dependent variable questionnaires to avoid participants recording answers based on how hungry they felt during the day. Ultimately, the researcher adhered to the BPS Ethics Code (BPS Ethics Committee, 2021) to omit a potential confirmation bias during the analysis and interpretation of the data (i.e., selecting only information from results which supports the set hypotheses).

Data analysis

Initially, the data was transferred from Qualtrics to SPSS (version 28). Repeated measures analysis of variance (ANOVA) was used to examine that the five assumptions were met, prior to analysis of the data (Robson & McCartan, 2015). This was then followed by the main analytical method, multivariate analysis of variance (MANOVA) which tested the three main hypotheses. Further exploratory tests were conducted.

Assumption 1 (dependent variable must be measured at continuous level) and assumption 2 (independent variable should be categorical) were met. Assumption 3 (there should be no significant outliers) was met; the data contained some outliers, but they were not extreme; according to Aguinis *et al.* (2013), the cut off for a potential outlier is plus or minus 2.24 standard deviation. Assumption 4 (the dependent variables should have a normal distribution) was significant in some cases and therefore, according to Shapiro-Wilk's significance, this assumption was violated. However, according to Lumley *et al.* (2002), if the sample size exceeds thirty participants, minor violations do not pose a problem and, therefore, MANOVA tests can be conducted; no participants were excluded from the data analysis. Furthermore, Assumption 5 states that sphericity must be equal, in other words, the assumption is met if variances across all conditions are equal, therefore the power significance would be insignificant (Field, 2016). The power for Mauchly's Test of Sphericity was insignificant in all cases; therefore, this assumption was met.

Results

Main hypotheses

The following main hypotheses were tested using repeated measures MANOVA: Hypothesis 1; there is a significant difference in participants' work performance before, during, and after two consecutive days of IF. Hypothesis 2; there is a significant difference in participants' mood, before, during, and after two consecutive days of IF. Hypothesis 3; there is a significant difference in participants' distraction, before, during, and after two consecutive days of IF.

MANOVA (Robson & McCartan, 2015) was used to establish if there were any changes across time, particularly in Week 2, during IF.

Table 1 reports the means and standard deviations for week 1 (in other words, before IF) week 2 (during IF) and week 3 (after IF). In some cases, there were slight differences in the explored variables means, across the three weeks, whereas in others, the means were almost equal in weeks 2 and 3.

Table 1

Descriptive Statistics with Mean and Standard Deviation of Task Performance, Contextual Performance, Counterproductive Work Behaviour, Distraction, Positive Mood and Negative Mood across Week 1, Week 2, and Week 3

Weeks	*M*	*SD*	*N*
Week1TaskPerformance	19.03	4.56	33
Week2TaskPerformance	17.39	4.75	33
Week3TaskPerformance	17.29	4.87	33
Week1ContextualPerformance	25.13	6.71	33
Week2ContextualPerformance	22.68	8.52	33
Week3ContextualPerformance	22.58	7.76	33
Week1CounterproductiveWorkBehaviour	10.22	3.74	33

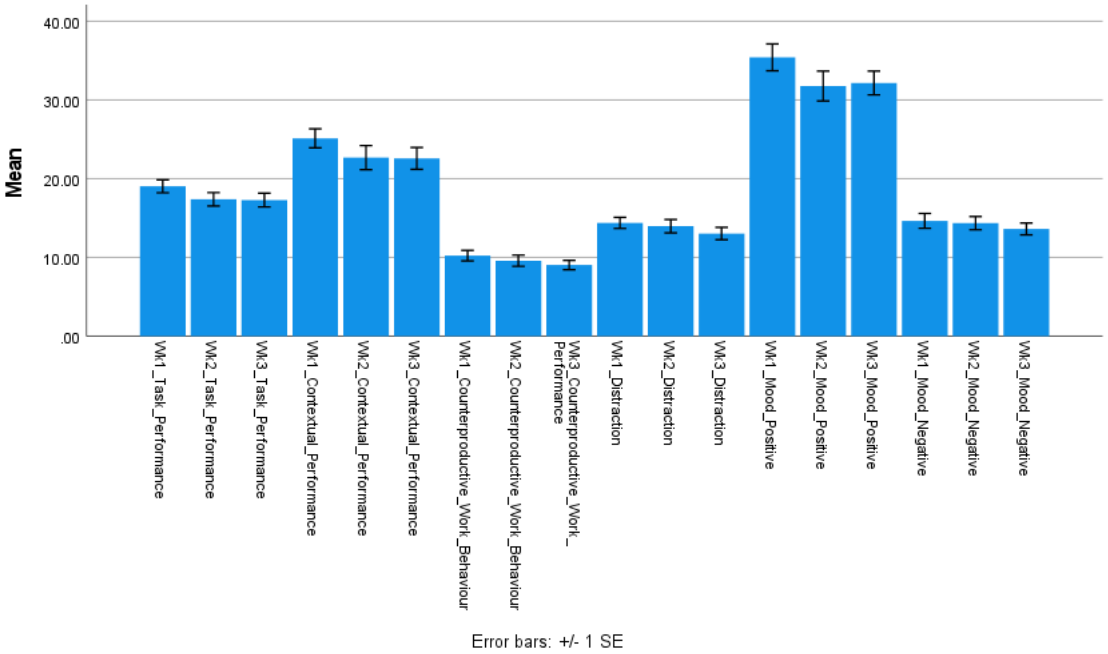
Week2CounterproductiveWorkBehaviour	9.58	3.96	33
Week3CounterproductiveWorkBehaviour	9.03	3.31	33
Week1 Distraction	14.39	3.94	33
Week2 Distraction	13.97	4.68	33
Wee3 Distraction	13.03	4.35	33
Week1PositiveMood	35.42	9.51	33
Week2PositiveMood	31.77	10.59	33
Week3PositiveMood	32.16	8.39	33
Week1NegativeMood	14.65	5.24	33
Week2NegativeMood	14.35	4.67	33
Week3NegativeMood	13.61	4.19	33

MANOVA reported that a statistically significant difference in IWP, distraction, and mood before, during, and after IF was not found, F (2, 27) = 1.04, p = .336; Wilk's Λ = .928, partial $\eta 2$ = .38. This result does not support any of the three hypotheses, in other words, IF did not result in a statistically significant difference in participant's IWP, mood, and distraction before, during and after two consecutive days of IF. Hence, post-hoc tests could not be conducted to test out any further possible differences, such as determining which dependant variable(s) were significant.

Despite the fact that differences were deemed statistically insignificant, a visual representation can note how these fluctuated over time. Figure 1 provides a visual representation of the differences across the three weeks study and of each dependent variable.

Figure 1

Means of dependent variables with error bars representing the standard errors



Consequently, as argued in the study of Appleton & Baker (2015), distraction may independently influence mood, and work performance. Hence, Pearson's Correlation coefficient was primarily performed to evaluate the relationship between distraction and mood in all weeks, and distraction and IWP separately in all weeks. It is important to note that for Pearson's correlation, Overall Mood was calculated as Positive Mood minus Negative Mood in SPSS.

Table 3

Inferential statistics with Pearson's Correlation and significance (p value) of the relationship between Distraction and Mood and Distraction and each sub-scale of Individual Work Performance in Week 1, Week 2, and Week 3

	Week 1	Week 2	Week3
Distraction & Mood	-.29	-.68**	-.43*
Distraction & Task P	-.18	-.46*	-.18
Distraction & C. P	-.08	-.38*	-.16
Distraction & CWB	.33	-.05	.41*

Note. *Mood = Overall Mood, Task P = Task Performance, C.P = Contextual Performance, CWB = Counterproductive Work Behaviour. *p = <.05, **p = <.01*

Table 3 illustrates that there was a significant strong negative relationship between distraction and overall mood in week 2, during IF, (r = -.68, p = 0.001). Similarly, there was a significant weak negative relationship between distraction and overall mood in week 3 (r = -.43, p = 0.014). There was a significant weak negative relationship between distraction and task performance in week 2 (r = -.46, p = 0.008). There was also a significant weak negative relationship between distraction and contextual performance in week 2, during IF, (r = -.38, p = 0.035). Lastly, there was a significant weak positive relationship between distraction and counterproductive work behaviour in week 3, after IF (r = .41, p = 0.022). The following scatterplots display visual representations of the five correlations above.

Figure 2

A visual representation of a relationship between distraction and mood in week 2

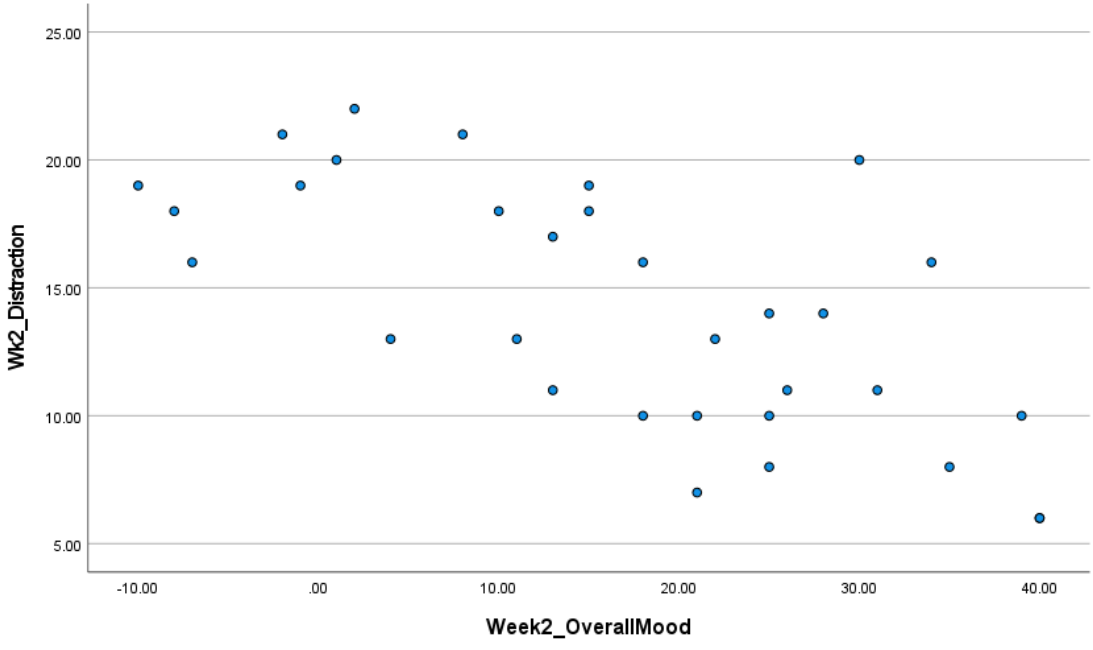


Figure 3
A visual representation of a relationship between distraction and mood in week 3

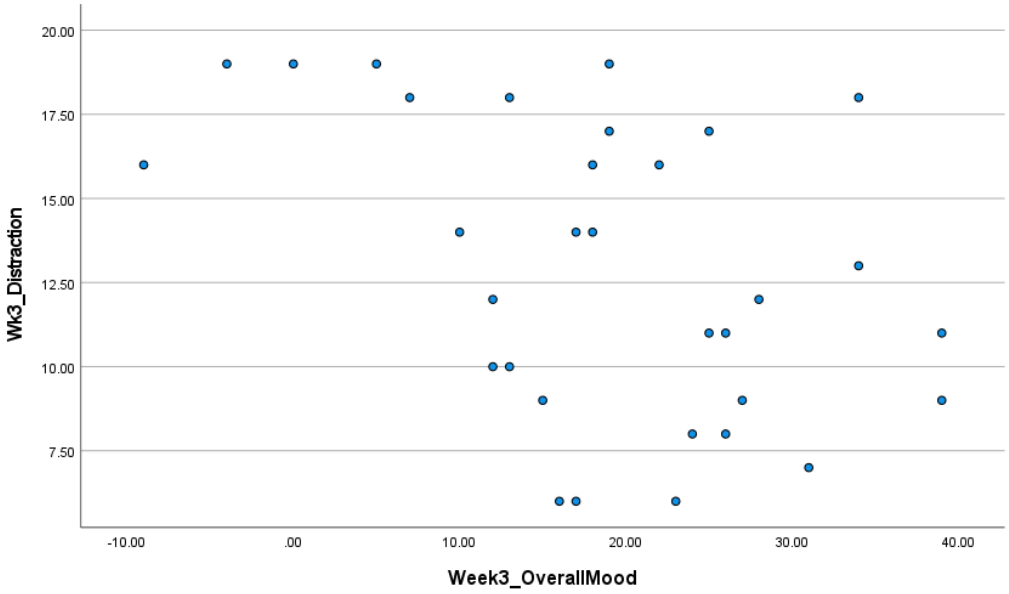


Figure 4
A visual representation of a relationship between distraction and task performance in week 2

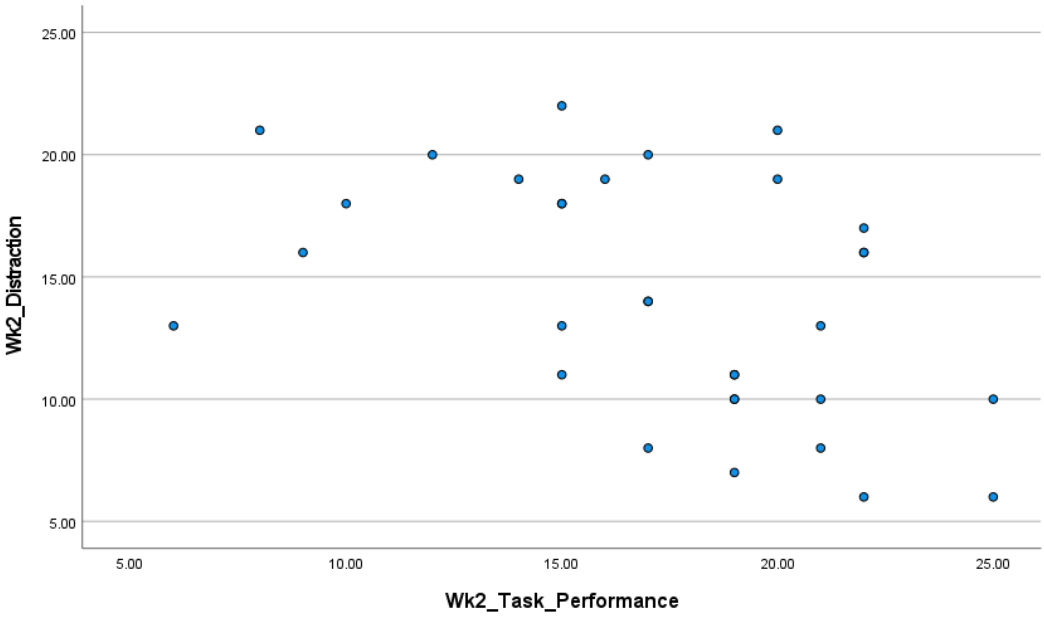


Figure 5
A visual representation of a relationship between distraction and contextual performance in week 2

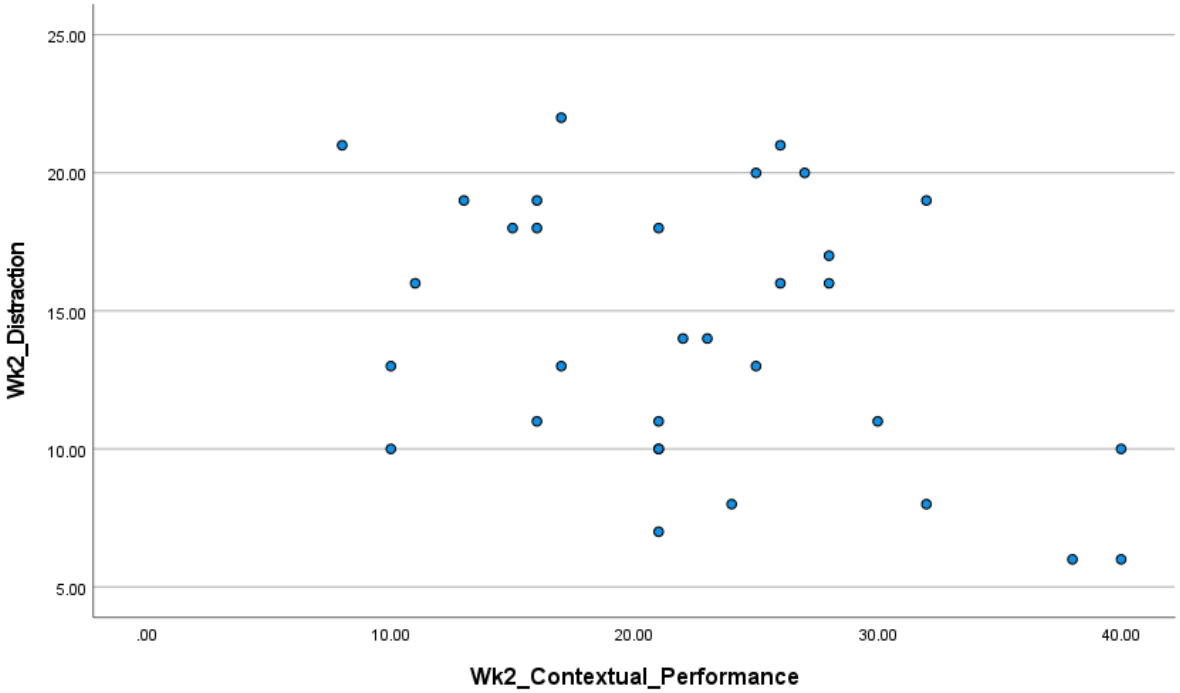
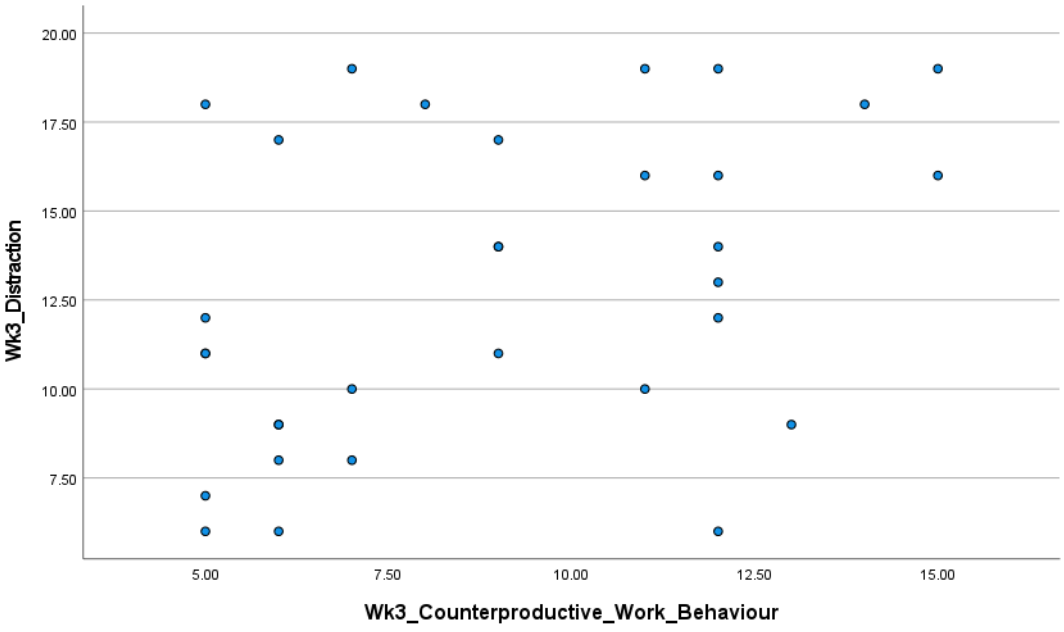


Figure 6
A visual representation of a relationship between distraction and counterproductive work behaviour in week 3



Examining the confounding and demographic variables

Pearson's correlational tests were conducted to assess potential relationships between the following variables: age, job tenure, and fasting experience and the dependent variables. Table 4 informs that there was a significant weak positive relationship between age and mood in week 3 (r = .37, p = 0.036). This relationship is

also visually represented in Figure 7. Interestingly, there was a significant weak positive relationship between fasting experience and CWB in week 1 (r = .39, p = 0.023), also provided in Figure 8, and a significant weak negative relationship between the same variables in week 2 (r = -.38, p = 0.029), observed in Figure 9.

Table 4

Inferential statistics with Pearson's Correlation and significance (p value) of the relationship between age, job tenure, and fasting experience with each dependant variable

	Week 1	Week 2	Week3
Age & Task P	.07	-.08	.20
Age & C. P	.12	-.20	.02
Age & CWB	-.29	-.03	-.02
Age & Distraction	-.19	.01	.04
Age & Mood	.52	-.13	.37*
Job Tenure & Task P	-.13	-.07	-.11
Job Tenure & C. P	.07	-.17	-.05
Job Tenure & CWB	.14	.12	.00
Job Tenure & Distraction	.02	.02	-.28
Job Tenure & Mood	-.07	-.07	.09
Fasting Experience & Task P	.08	.14	-.19
Fasting Experience & C. P	.14	.09	-.24
Fasting Experience & CWB	.39*	-.38*	.02
Fasting Experience & Distraction	.08	-.24	-.13
Fasting Experience & Mood	.52	.02	-.13

Note. *Mood = Overall Mood, Task P = Task Performance, C.P = Contextual Performance, CWB = Counterproductive Work Behaviour. *p = <.05, **p = <.01*

Figure 7

A visual representation of a relationship between age and overall mood in week 3

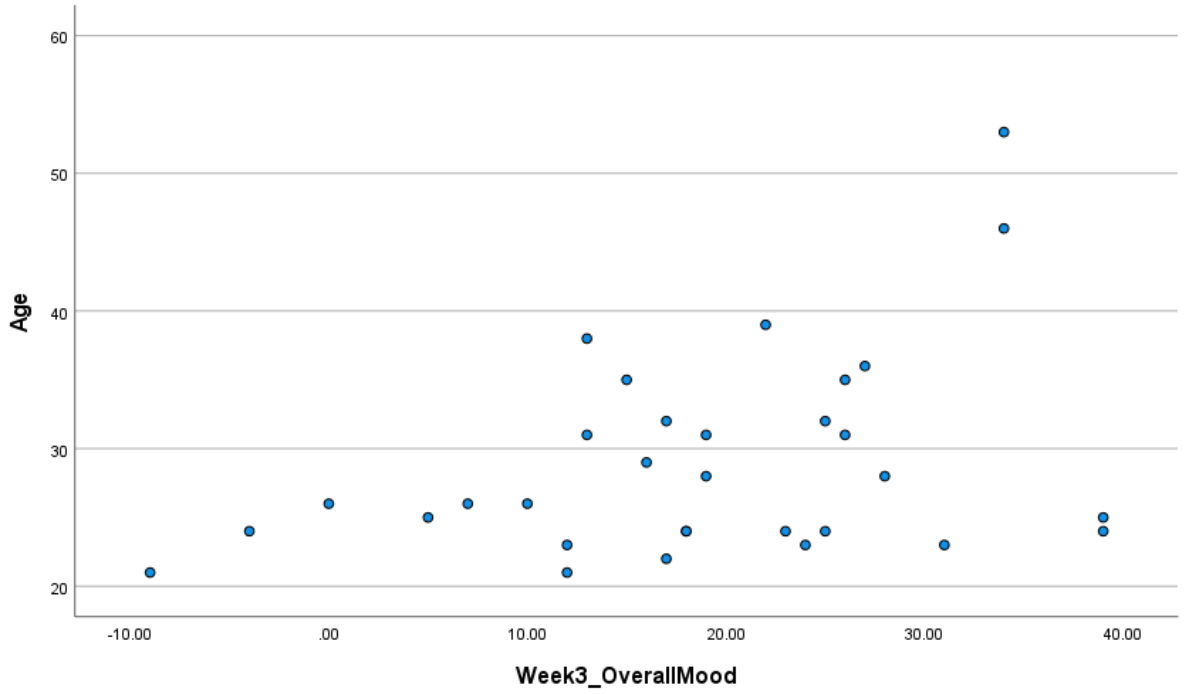


Figure 8

A visual representation of a relationship between fasting experience and CWB in week 1

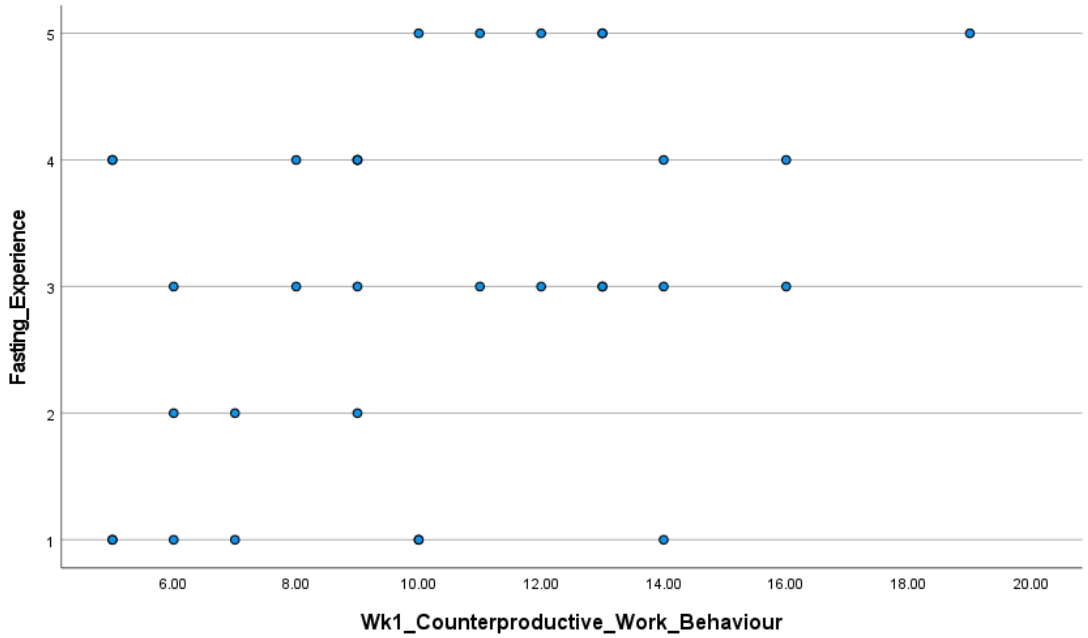
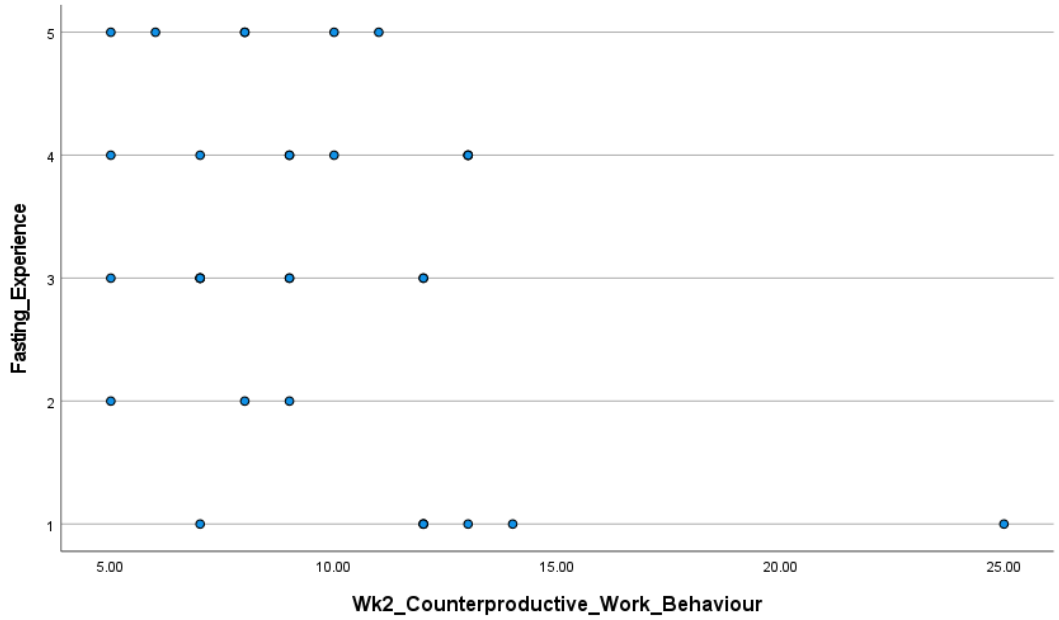


Figure 9

A visual representation of a relationship between fasting experience and CWB in week 2



Further repeated measures ANOVA tests were conducted to check for any potential differences derived from the gender demographic and fasting social support covariate. ANOVA reported a statistically insignificant difference in gender, Wilk's Lambada = .82, F (12, 10) = 91, p = .538 and social support, Wilk's Lambada = .83, F (12, 10) = 81, p = .636.

Discussion

A considerable amount of literature demonstrated that IF may provide physical benefits, such as improvements in cholesterol, a better weight management and control the blood pressure (Sundfør et al., 2018). Nonetheless, the influence that IF could have on certain cognitive aspects at work, specifically work performance, mood, and distraction was deemed insufficiently explored and resulted in mixed study findings. Consequently, the only study, to date, which investigated IF's influence on the three cognitive aspects is the pilot study of Appleton and Baker (2015). However, because of their limitations in sample size and instrument reliability, a replication of this study was deemed useful to test their findings further and contribute to the literature with a more convincing conclusion, which became the purpose of this study. Three hypotheses were tested.

Subsequently, the first hypothesis, there is a significant difference in participants' work performance before, during, and after two consecutive days of fasting, was not supported, as illustrated by the MANOVA results. Hence, this suggested that the intervention of IF for two consecutive days at work did not create a statistically significant difference, when compared to the two consecutive days in which participants followed their habitual eating style. Furthermore, the current study used a more reliable instrument to measure work performance, in comparison to the replicated study, where this aspect was measured as the perceived work performance. Despite this change, the current finding remained in line with that of Appleton and Baker (2015), where no associations were found on IWP, as a result of hunger. Previous studies (Harder-Lauridsen et al., 2017; Gudden et al., 2021) mentioned in the above literature review sustained that IF's influence on work performance is not sufficiently evidenced due to inconsistencies of methodologies in the study, hence the current finding is only in line with the replicated study.

Conversely, the current finding contradicts that of Cherif et al. (2015), in which IF was examined and it was conveyed that this dieting method influenced the cytokine expression (essential in cell signaling and therefore motor activity), and hence led to cognitive deficits, such as vigilance, memory, and attention, both at rest and during physical performance. This finding is particularly interesting, because it reinforces the fact that IF elicits similar outcomes for various types of working environment (i.e., those which are more mentally demanding, more physically demanding, or both). The current insignificance of IF on IWP could be explained by the participants' experience of fasting. For example, twenty-one participants of the current sample size noted that they had from a little to more fasting experience and, according to Ma et al. (2021), this aspect was considered to moderate certain psychological influences, such as wellbeing. Therefore, even if this study did not examine the fasting experience's direct influence on IWP, it could be understood that participants' fasting experiences may have been a factor which contributed to the current insignificant results.

Similarly, the current finding does not coincide with that of Ooi et al. (2020), where it was found that, when IF is practised as part of a lifestyle, this may, in turn, prevent cognitive irregularities in elderly people. Hence, this suggests that IF does produce a difference in cognitive aspects. Although this study did not examine IWP, and specifically at work, it reinstated the fact that IF could prompt a significant difference, if practised regularly. This is noteworthy, because the current study's intervention lasted only for two consecutive working days; thus, this aspect may explain the insignificant difference IF had on individuals' work performance. Nevertheless, the systematic review of Owen et al. (2012) underlined the fact that 2 hours of fasting and a high dose of glucose (consumed after fasting) resulted in a short- term increase in working memory. Despite the fact that the latter study was not conducted in work settings, it reinstates that even a few hours of fasting can result in a significant difference in memory. Therefore, even if the current study's intervention would have lasted for longer, it could have elicited the same results.

Additionally, upon further exploratory inspection, the current study reported a significant positive association between fasting experience and counterproductive work behaviour in week 1 (no fasting), followed by a negative relationship in week 2 (during fasting). This conveys the fact that, on a regular basis, subjects of the current study tended to elicit more counterproductive behaviours, such as complaining, focusing on negative aspects, and amplifying problems at work. On the other hand, during the two consecutive days of fasting, a higher fasting experience correlated with less negative behaviour at work. This finding could be explained by participants' decrease of blood glucose levels, and therefore reduced energy, which may have impacted their willingness to engage in counterproductive behaviours (Fairclough & Houston, 2004). This is, to a certain extent, in line with the study of Ma et al. (2019), where it was highlighted that less previous fasting experience was associated with higher negative mood; despite the fact that this study only examined the effect of fasting experience on mood, whilst IWP was not examined. Hence, according to the researcher's knowledge, the current study is the first investigation, to date, which found a relationship between individuals' fasting experience and IWP. Thus, this finding is substantial to consider in future studies, as it may reinstate the fact that fasting may

decrease counterproductive work behaviours, and therefore, encourage more optimistic attitudes at work, resulting in more customer satisfaction, employee productivity, organisational effect and, hence, higher profitability (Koys, 2001; Krekel et al., 2019; Harter et al., 2020).

Equally, the second hypothesis, there is a significant difference in participants' mood, before, during, and after two consecutive days of IF, was not supported. In other words, mood was not significantly influenced by two consecutive days of IF at work. Firstly, this finding is in line with the replicated study (Appleton & Baker, 2015), in which it was outlined that there was no association between IF and mood, but in fact, mood was impacted by distraction. This finding also coincides with that of Qian et al. (2022), which explained that mood is occasionally influenced by a disruption in the circadian rhythm, and not by abstention from food. However, participants of the current study fasted only during their working hours (not 16 hours) and this information was not recorded. Hence, there is a chance that the current results may have been affected by a potential small number of working hours, which may be interpreted as too short to enable individuals to experience negative mood. Similarly, the data was collected during the Christmas period, and although demographic information about religious beliefs was not collected, mood could have been positively (or negatively) influenced by the expectation of this season, also known as the "Santa Claus Effect" (Kelly, 2017). More specifically, studies have conveyed that Christmas rituals increased positive well-being, whereas conflict during this period decreased it (Paez, 2011; Kelly, 2017). However, this aspect is not sufficiently evidenced, and others may argue that such statements remain a myth (Colaco, 2013), particularly because Christmas is also the time during which most individuals book annual leave. For example, these suggestions may be assimilated to a placebo induced expectation of positive mood (Baker et al., 2022) and not dependent of an actual event (i.e., Christmas).

Conversely, even though there is not sufficient literature, in terms of IF, that could compare to the current study's findings, other forms of fasting are still not in line with the current finding. For example, Campante and Yanagizawa-Drott (2013) and Nugraha et al. (2017) conveyed that Ramadan fasting (daytime IF) elicited negative influences on mood and feelings of irritability, and sleep, which was argued to eventually influence other cognitive aspects (Rad et al., 2022). Furthermore, upon further exploratory correlational tests, it was found that mood was positively correlated with age in week 3, which suggested that the older the individual was, the more positive mood they were likely to experience during the last week of the study. However, this finding does not coincide with that of Mauno et al. (2013), which suggested that younger individuals experienced less anxiety and more job satisfaction. However, the current study's relationship between these two variables is weak; this correlation also revealed to take place during the last week of the study (i.e., closer to Christmas and the last part of the study) and hence this may explain the current results.

Similarly, the literature suggested that fasting experience (Alsaeed et al., 2019; Ma et al., 2021) and social support (Karfopoulou et al., 2016; Harter et al., 2020) may be associated with enhanced positive mood. However, the current study found that such associations were insignificant in the current sample. The first finding may be explained by the fact that this study lasted for the working hours of each individual. Therefore, as this information is unknown, it could be that the current sample worked for shorter than the mean amount of UK working hours (7-8 hours) (Watson, 2023) and therefore they would not elicit such mood adversity. The latter finding may be explained by the fact that only 18 people of the current sample disclosed to have a social support, and this may not account for the overall mood for the whole sample.

Ultimately, hypothesis 3, there is a significant difference in participants' distraction (as a consequence of IF), before, during, and after two consecutive days of IF, was not supported. This is in line with Appleton and Baker (2015), as they conveyed that distraction was not influenced by hunger. However, the current study argued that distraction, during hunger, could be perceived as a consequence of IF (according to attention bias approaches; Beard et al., 2012; Lev-Ari et al., 2021), and not an independent factor contributing to a moderation of other cognitive aspects. Furthermore, the replicated study highlighted that distraction was independently (from hunger) and positively correlated with low positive mood and perceived work performance on fast days, but not on non-fast days. This was tested with an implementation of a reliable measure for distraction (CFQ), measuring the real influence of, rather than the perceived distraction. Despite this change, the current study reported that distraction was associated with lower mood, during and after fasting, despite this being a relational, and not a causal effect, meaning that this finding could conjunctively have been affected by other factors; or that low mood could lead to distractibility and vice versa. Similarly, as reported by Appleton and Baker (2015), the current study also found a (negative) relationship between distraction and IWP (i.e., task performance, and contextual performance), during fasting, and a positive relationship between distraction and counterproductive work behaviour in week 3. This implies that less distraction was associated with more effective planning (i.e., task performance) and initiative behaviours (i.e., contextual performance), despite fasting. Similarly, less

distraction was associated with less adverse, negative behaviour at work, after fasting (i.e., counterproductive work behaviour). Therefore, the current study reinstated the findings of the replicated study. However, distraction could directly be influenced by certain confounding factors which further studies could take into consideration. For example, Attention Deficit Hyperactivity Disorder (ADHD) is a disorder characterised by an inability to sustain attention for long periods of time, therefore resulting in individuals diverting their attention (Cormier, 2008). Furthermore, Bozionelos and Bozionelos (2013) found that individuals with ADHD are more prone to underperform, procrastinate, and are unable to maintain attention at long-term tasks, despite that this study does not specify any such effects in work settings. Accordingly, a systematic review suggested that there is not enough evidence to indicate the real effectiveness of fasting on individuals with ADHD in the workplace (Lauder et al., 2022). Hence, despite the fact that there is limited evidence on ADHD being a confounding variable for distraction, there is a possibility that this may be the case and future studies would benefit from considering this information.

Relatedly, this study was subject to limitations, including the one mentioned above (ie., ADHD), as some of the current study's participants are diagnosed with ADHD, which may have compromised their ability to focus. For instance, despite the insignificant results, the current study did not include a control group, which, if implemented, may have contributed to a clearer explanation of these results (Thomas, 2022). Thus, if future studies will include a control group, when focusing on measuring similar variables in relation to IF, they would benefit from better accuracy of results. Additionally, another limitation of this study is that IF's length depended on each distinct participant's working hours, meaning that some people fasted longer/shorter than others. This may account for the insignificance of results in the current study; hence, future studies could focus not only on examining IF for longer, but for a consistent pattern of working hours among participants to elicit more accurate results. Ultimately, this study could be extended into a mixed-method design (i.e., qualitative study with unstructured interviews) which may explore other reasons contributing to the current insignificant results; and a longer longitudinal study which could measure the long-term effects of continuous and habitual IF during working hours.

Conclusion

The current study was a replication of Appleton and Baker (2015) with some alterations to the certain measures with the aim to provide better reliability. Despite this change, the current study found similar results, reinstating the findings of the replicated study. Therefore, if the current study is not affected by the publication bias (Easterbrook *et al.*, 1991), these findings have the potential to benefit the Occupational Psychology Field by informing that IF is a safe intervention, which can be practised during working hours without any adverse cognitive effects that may negatively influence work performance, mood, and distraction. Ultimately, the current study provided research implications for other future studies by informing that two consecutive days of IF are not sufficient to draw conclusions on its potential influence on individual work performance, mood, and distraction at work.

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