ORIGINAL CONTRIBUTION

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The effects of a hot drink on nasal airflow and symptoms of common cold and flu*

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SUMMARY

Hot drinks are a common treatment for common cold and flu but there are no studies reported in the scientific and clinical literature on this mode of treatment. This study investigated the effects of a hot fruit drink on objective and subjective measures of nasal airflow, and on subjective scores for common cold/flu symptoms in 30 subjects suffering from common cold/flu. The results demonstrate that the hot drink had no effect on objective measurement of nasal airflow but it did cause a significant improvement in subjective measures of nasal airflow. The hot drink provided immediate and sustained relief from symptoms of runny nose, cough, sneezing, sore throat, chilliness and tiredness, whereas the same drink at room temperature only provided relief from symptoms of runny nose, cough and sneezing. The effects of the drinks are discussed in terms of a placebo effect and physiological effects on salivation and airway secretions. In conclusion the results support the folklore that a hot tasty drink is a beneficial treatment for relief of most symptoms of common cold and flu.

Key words: hot drink, common cold, flu, nasal airflow, cough, sneezing, rhinomanometry

INTRODUCTION

Acute rhinosinusitis associated with common cold and flu is one of the most common diseases [(1)]. Despite the widespread folklore that hot drinks are an effective treatment for colds and flu, and the use of hot drink formulations for many current common cold medicines, there appears to be no evidence base in the medical literature supporting the efficacy of this common treatment for common cold and flu. There are a few studies that have investigated the effects of hot drink on nasal resistance and other nasal functions in healthy subjects, but surprisingly, no reports have been found in the literature on the effects of a hot drink on common cold and flu symptoms. Martin et al. reported that application of either cold (4-6°C) or warm water (44-52°C) to the oral mucosa in healthy subjects caused an increase in nasal airway resistance, but that application of tepid water (26-28°C) did not alter nasal resistance [(2)]. Saketkhoo et al. reported that drinking hot water or soup (65°C) increased nasal mucus velocity in healthy subjects, but did not change nasal airway resistance [(3)]. Recently, Lal et al. reported that ingestion of hot water (82°C) decreases nasal cross sectional area as measured by acoustic rhinometry in healthy subjects [(4)]. With these contrasting results from previous studies, and the fact that none of the previous studies included any subject suffering from common cold, the effects of hot drink when suffering from common cold remains unclear.

The present study will investigate the effects of a hot drink or similar drink at room temperature on nasal conductance as measured by rhinomanometry, and on upper airway symptoms measured by subjective scores, in patients suffering from common cold and flu.

MATERIALS AND METHODS

Subjects

Subjects that responded to an advertisement were screened by the investigator to ensure they met the inclusion and exclusion criteria for the study. Anterior rhinoscopy using a Thuddicum speculum was performed to detect any gross nasal septal deviation or the presence of nasal polyps. Those subjects eligible for the study were randomly allocated to receive either a hot drink or a drink at room temperature. The subjects enrolled in the study were from the staff and student population of Cardiff University. In order to qualify for entry to the study patients had to be aged 18 years and above, suffering from symptoms of common cold/flu like illness of less than 7 days duration, suffering from at least three common cold symptoms (runny nose, sneezing, blocked nose, sore throat, cough) and scoring at least two symptoms as moderate on a four point ordinal scale (0- not present, 1- mild, 2- moderate, 3- severe). Subjects were excluded from the study if they were suffering from any nasal disease (nasal polyps, chronic rhinitis, severe septal devi-

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ation) or other clinically significant disease, and if they had taken any medication that could influence common cold symptoms, and if they had ingested any hot food or drink within the previous hour.

Procedures

At baseline, subjects scored their subjective sensation of nasal airflow and symptoms of common cold. Total nasal airway resistance was measured by the technique of posterior rhinomanometry. Within 10 minutes of these measurements the subjects drank either a hot drink or one at room temperature. The subjective scores and measurements of nasal airway resistance were repeated immediately after finishing the drink and at 15 minutes and 30 minutes after the drink.

Drink treatment

A commercially produced cordial drink (Robinsons Apple & Blackcurrant) was used for this study. Twenty ml of cordial was diluted with 80 ml of water to provide either a hot drink at 70°C (± 5°C) or a drink at room temperature (20°C ± 5°C). Subjects were asked to slowly sip the drink until it was all drunk, for up to a maximum of 10 minutes. The drink was marketed as containing no added sugars and as a low-calorie drink, and contained only 9 kcal or Calories per 100 ml of concentrate. The drink was purple in colour and had a distinctive blackcurrant smell, especially in the hot drink, with a slightly sweet and acidic flavour. Ingredients: water, fruit juices from concentrate (apple 8%, blackcurrant 2%, citric acid, natural colour (anthocyanins), acidity regulator (sodium citrate), sweeteners (aspartame, saccharin), preservatives (potassium sorbate, sodium metabisulphite) and natural flavouring.

Rhinomanometry

An NR6-2 rhinomanometer (GM instruments, Glasgow UK) was used in this study to measure nasal resistance to airflow using the technique of posterior rhinomanometry. The instrument measured nasal airflow at a sample pressure of 75Pa. Subjects breathed into a facemask whilst sealing their lips around a pressure sensing tube in the oral cavity. For each measurement of nasal airway resistance (NAR) two consecutive sets of four respiratory cycles were obtained and the coefficient of variation (CV) of these two sets was calculated. If the CV was 10% or less, the measurement was accepted and the mean NAR of the 8 respiratory cycles was calculated. If the CV was more than 10% then the respiratory cycle sets were discarded and the procedure repeated until a CV of 10% or less was achieved. If a CV less than 10% could not be obtained after three attempts the data was entered as missing. The results for rhinomanometry were expressed as conductance rather than resistance in order to be able to include data from subjects who were completely obstructed, as they would have a conductance of zero, which can be handled in statistical analysis, whereas a resistance of infinity could not be used in data analysis. Subjects who presented with complete or almost complete nasal obstruction were deemed to have a nasal conductance of zero.

Subjective symptom scores

A 100 mm visual analogue scale (VAS) anchored by the descriptors 'nose feels extremely clear (0 mm) and 'nose feels extremely blocked' (100 mm) was used to assess the sensation of nasal airflow prior to each measurement of nasal airflow with rhinomanometry. The scores represented the sensation of nasal airflow at the time of measurement.

Common cold symptoms of runny nose, cough, sneezing, sore throat, chilliness and tiredness were scored on VAS scales anchored by the descriptors; no runny nose (0 mm) -worst runny nose I can imagine (100 mm) etc. The scores represented the symptoms present at the time of assessment.

Sample size, statistics and efficacy variables

This was a pilot study and the size of the study population is estimated from the results of previous studies on the effects of hot drinks on nasal airway resistance. Because of differences in measurements and study populations it was not possible to do a formal power calculation. Martin and Tansy [2] used six subjects, and Lal et al. [4] used eight healthy adults. In order to allow for an increased variability in this study it was proposed to use a population of thirty subjects (i.e. 15 subjects for each type of drink).

The primary efficacy variable was pre-defined in the protocol as the change in nasal conductance of airflow from before the drink to immediately after the drink. Secondary efficacy variables were; change in subjective scores of nasal obstruction and the symptoms of common cold from before the drink to immediately after the drink, and at other time points.

The Statistical Package for the Social Sciences version 11 (SPSS 11) for the Macintosh platform was utilised for statistical analysis. It was assumed that the data was not normally distributed and all data was analysed with the non-parametric Wilcoxon signed ranks test.

Ethical approval and finance

The study was reviewed and approved by the South East Wales Local Research Ethics Committee and conducted in accordance with the International Conference of Harmonization's 'Guidelines for Good Clinical Practice' and the World Medical Association's 'Declaration of Helsinki'. The study was financed from the research funds of the Common Cold Centre, Cardiff University and did not receive any commercial sponsorship.

RESULTS

Subjects

A total of 38 subjects were screened for the study. Six subjects failed to fulfil the inclusion/exclusion criteria and were exclud-

ed, and a further two subjects failed to complete the study, leaving 30 protocol valid subjects with 15 subjects in each treatment group. There were 21 females (70%) and nine males (30%). The mean age of the study population was 20.8 years (range 18 to 36 years).

Drinks

The mean temperature of the hot drink was 73.7°C (range 70,0°C to 75,0°C) and the mean temperature of the room temperature drink was 21,8°C (range 21,0°C to 22,0°C). The mean time taken to consume the hot drink was 5.2 minutes, and 1.4 minutes for the room temperature drink. All the subjects managed to finish their drinks within the given 10 minutes.

Objective and subjective effects on nasal airflow

The effects of ingestion of the two drinks on the subjective perception of nasal airflow are shown in Figure 1. The room temperature drink caused a non-significant trend towards scores for increased sensation of nasal airflow, whereas the hot drink caused an immediate improvement in sensation of airflow that was sustained for 30 minutes.

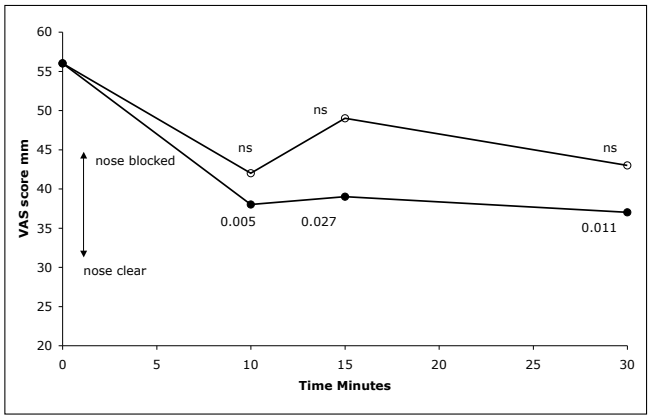

Figure 1. Subjective scores for nasal airflow on 100mm visual analogue scale, before and up to 30 minutes after drink. Open symbols drink at room temperature; filled symbols hot drink. P values refer to comparisons with baseline score (ns = no significant difference from baseline). Each point represents the median value of data from 15 subjects.

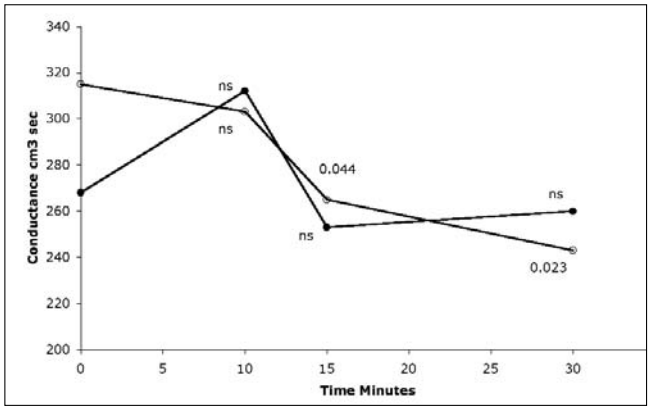

Figure 2. Conductance of nasal airflow, before and up to 30 minutes after drink. Open symbols drink at room temperature; filled symbols hot drink. P values refer to comparisons with baseline score (ns = no significant difference from baseline). Each point represents the median value of data from 15 subjects

The effects of ingestion of the two drinks on the objective measure of conductance of nasal airflow are shown in Figure 2. The room temperature drink caused significant trend of decreased nasal airflow, whereas the hot drink did not cause any significant changes in conductance.

Common cold symptoms

The effects of ingestion of the hot drink on common cold symptom scores are shown in Figure 3. All of the six symptoms were decreased in severity after the hot drink with immediate effects on cough, sore throat, chilliness and tiredness, and relief at 15 minutes after the hot drink for runny nose and

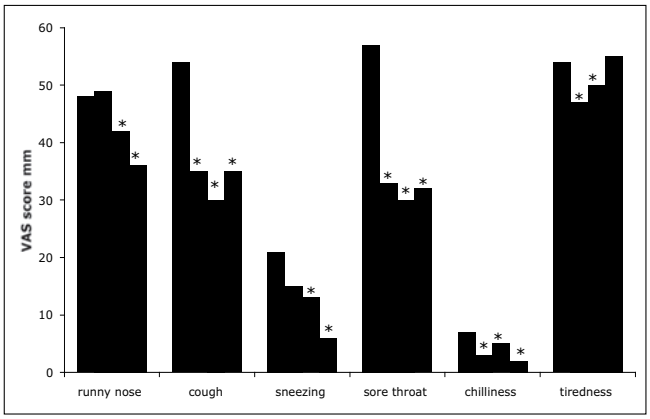

Figure 3. Effects of a hot fruit drink on common cold symptoms scored on visual analogue scales (0 = no symptom, 100 = worst symptom I can imagine). Each bar represents the median value of data from 15 subjects, for baseline, and 10, 15 and 30 minutes after the drink. Statistically significant differences from baseline ($p < 0.05$) are indicated by an asterisk.

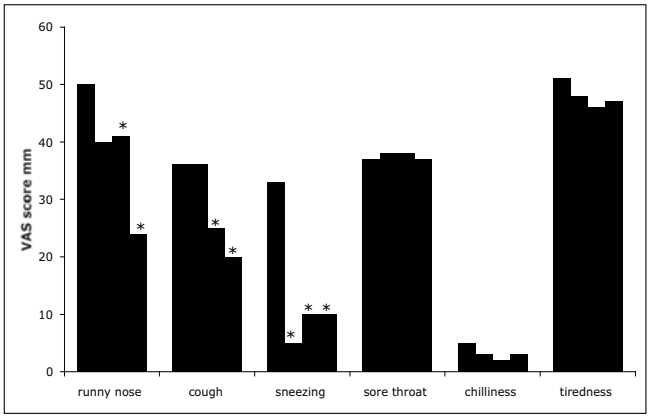

Figure 4. Effects of a fruit drink at room temperature on common cold symptoms scored on visual analogue scales (0 = no symptom, 100 = worst symptom I can imagine). Each bar represents the median value of data from 15 subjects, for baseline, and 10, 15 and 30 minutes after the drink. Statistically significant differences from baseline ($p < 0.05$) are indicated by an asterisk.

sneezing. The symptom relief was still significant for 30 minutes after the hot drink for all of the symptoms except tiredness.

The effects of ingestion of the room temperature drink on common cold symptom scores are shown in Figure 4. In contrast to the overall relief of symptoms provided by the hot drink, only three of the symptoms were relieved with the room temperature drink; runny nose, cough and sneezing. There were no significant changes in the symptom scores for sore throat, chilliness and tiredness. The comparisons between baseline score and the subjective scores after the drinks involve multiple statistical comparisons and caution is necessary when interpreting any individual result. However, the magnitude of the responses and the number of statistically significant differences ($p < 0.05$) do support the overall benefit of the drinks in decreasing symptom severity.

DISCUSSION

The results demonstrate that ingestion of a hot drink does not cause any significant change in nasal conductance but that it does provide some subjective relief of nasal obstruction as shown in Figure 1. The measures of nasal conductance (Figure 2) show an overall trend for a decrease in conductance or nasal congestion. There is a small difference in the baseline levels of nasal conductance, but this is unlikely to influence the results, as the difference seems large because of the expanded scale of the axis of the graph. The decrease in nasal conductance from baseline is statistically significant ($p < 0.05$) in the group that ingested the room temperature drink, and the lack of any significant change in the hot drink group may be due to an initial trend towards increased conductance immediately after the drink that negated any effects of an overall trend towards congestion. Decreases in nasal conductance have been observed in studies on subjects with common cold when the subjects were merely rested in the laboratory environment and not exposed to any treatment [5]. Clarke and Eccles reported a paradoxical relationship between an objective decrease in conductance of airflow (nose becoming more congested) and a subjective perception of increased nasal airflow (nose decongesting) in subjects with common cold when they were resting in a laboratory environment for a period of up to 2 hours [5]. A similar paradoxical relationship between objective and subjective measures of nasal obstruction has been reported in studies on nasal decongestants [6]. The slow trend towards nasal congestion in resting subjects may be due to a decrease level of sympathetic activity and decreased vasoconstrictor activity to the nasal blood vessels. It is not understood why subjects score improved nasal airflow even though the nose may be congesting. The paradoxical subjective improvement in nasal sensation of airflow does not appear to be a placebo effect as it is still present when subjects do not receive any type of treatment [5].

The results demonstrate that a hot fruit drink can provide subjective relief from all the six symptoms of common cold that were scored in this study. Ingestion of the same drink at room temperature only provided relief for three of the symptoms. This demonstrates the extra benefit provided by the increase in drink temperature and supports the traditional use of hot drinks to relieve common cold symptoms. There were some base-line differences in symptom severity between the two treatment groups, as with small group size it was not possible to balance the severity of all symptoms at baseline. The baseline symptom scores for sore throat and cough in the group taking the room temperature drink were less than the baseline scores in the group taking the hot drink. It is possible that if the symptom scores for sore throat and cough had been higher in the group taking the room temperature drink, then this group may have also had some significant reduction in symptom severity for these symptoms.

The drinks may provide symptom relief by a placebo effect where the subject believes that the drink will provide relief due to prevailing folklore [7]. The symptom relief may also be due to a 'physiological' effect of the drink where the taste, smell and temperature of the drink may promote salivation and airway mucus secretions to lubricate and soothe the upper airways. This demulcent effect of the drink may be more relevant for symptoms such as cough [8] and sore throat.

The symptom results also show some unexpected benefits as both the hot drink and the room temperature drink provided relief from the symptoms of sneezing and runny nose. This may be due to stimulation of branches of the trigeminal nerve that supply both the oral and nasal cavities such as the major palatine nerve [9].

This study may be criticised because it was not controlled with a placebo and that the symptom relief is merely a placebo effect. The benefit of a placebo effect should not be underestimated as in most cough medicines it has been estimated to provide at least 85% of the total benefit of treatment [10]. In the present study the drink at room temperature provided some control for the study but direct comparisons between the two data sets have not been made as it is not only the temperature of the drink that provides the benefit of symptom relief. The taste of the drink with both sweet and acidic components is similar to traditional colds remedies such as honey and lemon, and the stimulation of both sweet and acid gustatory receptors provides a maximum stimulus for salivation and airway secretions. The study drink had low sugar content, and traditional colds remedies often use a high sugar content. It is possible that even greater relief of colds symptoms, especially for cough and sore throat could have been obtained with a drink with higher sugar content [8].

CONCLUSIONS

The paradoxical sensation of improved airflow and a decrease in nasal conductance observed in this study is still poorly understood and does not appear to be due to a placebo effect. The study demonstrates that a hot fruit drink can provide subjective relief for common cold symptoms and that this effect may be to due to both physiological and psychological effects of the drink.

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FELLOWSHIP JOURNAL RHINOLOGY – 2009

The journal 'Rhinology' is offering a Fellowship of € 10,000.- during 2009 to enable a young researcher or clinician to visit another academic department with an established reputation in rhinology. The purpose of the visit is to observe or participate in clinical or basic research. It is specifically not intended to finance attendance at a meeting.

1. Candidates for "**Rhinology**" Travelling Fellowship should be under 40 years of age and either a medically qualified trainee or research worker in a University Department.

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3. There is no period prescribed for the duration of a visit but it is anticipated that Fellows will spend at least 4-6 weeks.

4. The Award will cover travel and assist with living expenses. Any part of a grant which is unexpended must be returned to the Rhinology Foundation.

5. Each Rhinology Travelling Fellow will be required to write a report on his or her visit which should also include where appropriate scientific work resulting from the Fellowship. This must be offered to "**Rhinology**" within six months of the return of the individual from the Fellowship.

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7. Applications for the Awards for 2009 must reach the offices of "**Rhinology**" before April 1st 2009 and must include the following:

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   d) Letter of acceptance from the head of the department, which they wish to visit.
   e) An outline of expenses.

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